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TETRA TECH

Kevin Scott
Project Manager

May 4, 2010

Mr. Dwayne Harrington (211MS211)
U.S. Environmental Protection Agency Region 2
Raritan Depot
2890 Woodbridge Avenue
Edison, NJ 08837-3679

Subject: Final Sampling and Analysis Plan
Riverside Avenue Site
Riverside Avenue, Newark, Essex County, New Jersey
EPA Contract No. EP-S7-06-01
TDD No. 0178
Document Tracking No. 0985

Dear Mr. Harrington:

Tetra Tech EM Inc. (Tetra Tech) is submitting the final sampling and analysis plan (SAP) for the Riverside Avenue Site located at 21-47 Riverside Avenue in Newark, New Jersey. If you have any questions regarding the final SAP, please contact me at (610) 364-2119.

Sincerely,

K Scott

Kevin Scott
Project Manager

Enclosure

cc: TDD File

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FINAL SAMPLING AND ANALYSIS PLAN

RIVERSIDE AVENUE SITE

NEWARK, NJ

Prepared for

U.S. Environmental Protection Agency Region 2
USEPA Facilities Raritan Depot
Woodbridge, NJ 08837-3679

Prepared by

Tetra Tech EM Inc.
7 Creek Parkway, Suite 700
Boothwyn, Pennsylvania 19061

EPA Contract No. EP-S7-06-01

Technical Direction Document No. 0178
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May 4, 2010

Prepared by	Approved by
K Scott	
Kevin Scott Project Manager	Andy Mazzeo Philadelphia Operations Manager

CONTENTS

FIGURES

<u>Figure</u> **<u>Page</u>**

TABLES

<u>Table</u> **<u>Page</u>**

1.0 INTRODUCTION

Under Eastern Area Superfund Technical Assessment and Response Team (START) Contract No. EP-S7-06-01, Technical Direction Document (TDD) No. 0178, U.S. Environmental Protection Agency (EPA) Region 2 tasked Tetra Tech EM Inc. (Tetra Tech) to conduct a site removal assessment at the Riverside Avenue Site located at Riverside Avenue, off of Route 21 in Newark, NJ. The sampling event will include the collection of liquid and solid samples (if available) from on-site tanks and water and pigments located within site buildings and to determine if asbestos-containing materials are present in pipe insulation located within an on-site building.

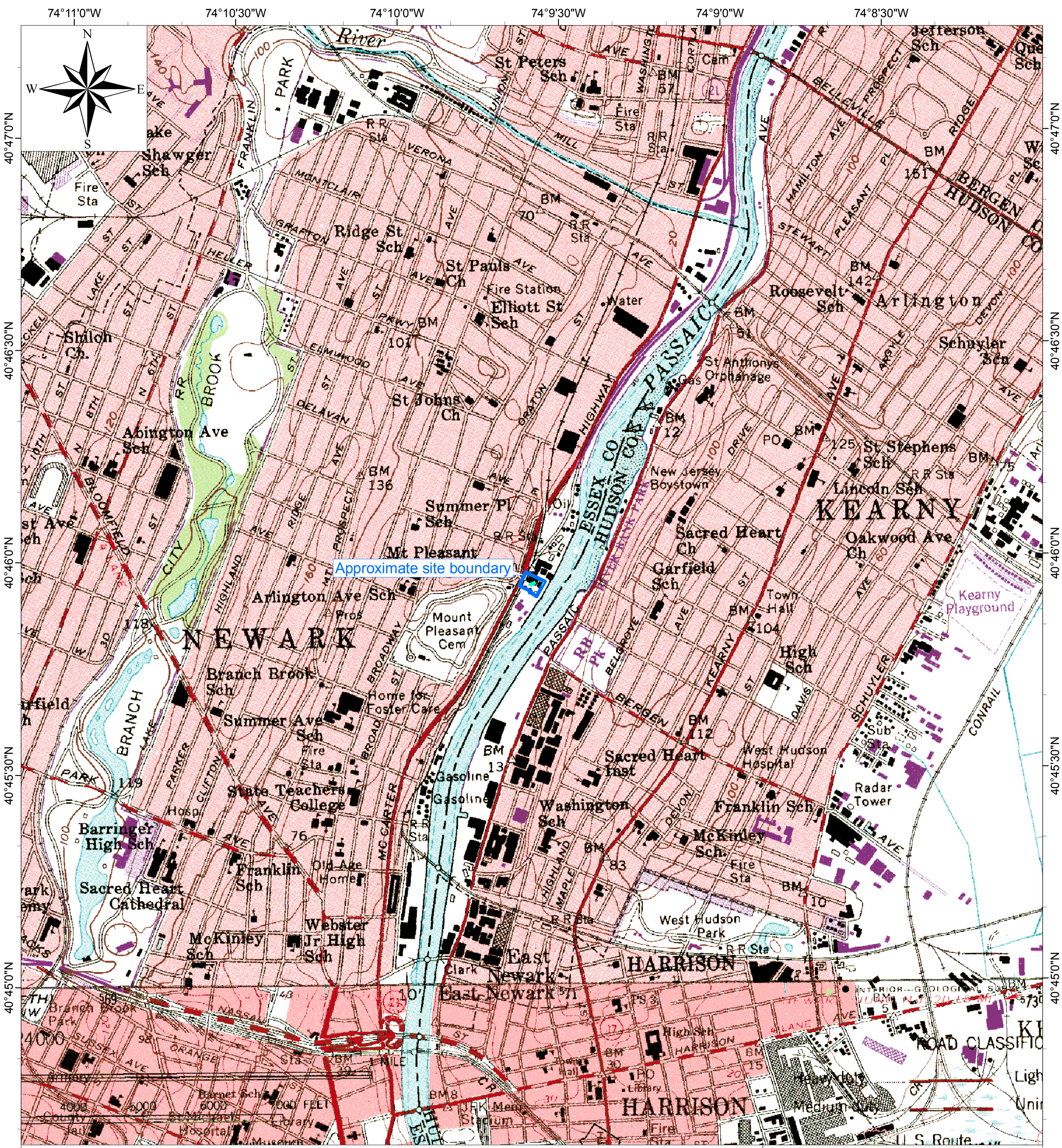
The purpose of the sampling and analysis plan (SAP) is to provide an outline of the sampling and analysis activities that support the assessment. This SAP provides site background information in Section 2.0; presents the project objective and data use, proposed field investigation, analytical parameters in Sections 3.0, 4.0, and 5.0; summarizes quality assurance (QA) and quality control (QC) procedures in Section 6.0; identifies project deliverables in Section 7.0; and provides a project schedule in Section 8.0. All references cited in this plan are listed in Section 9.0. Tetra Tech Standard Operating Procedures (SOP) cited in the text of this SAP are included in Appendix A.

2.0 BACKGROUND

This section describes the site location, presents a description and history of the property, and summarizes previous investigation activities conducted on and in the vicinity of the Riverside Avenue Site.

2.1 SITE LOCATION AND LAYOUT

The Riverside Avenue Site is located off Route 21 in Newark, New Jersey (see Figure 1, Site Location Map). The geographic coordinates for the approximate center of the site are 40.4556 degrees north latitude and 74.0935 degrees west longitude. The site is currently owned by the



Source: Modified from USGS 7.5-Minute Series Topographic Quadrangles: Elizabeth, New Jersey, 1967, Photorevised 1981; Orange, New Jersey, 1955, Photorevised 1981

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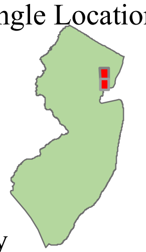
Quadrangle Location = ■



29 Riverside Avenue
Newark, Essex County, New Jersey

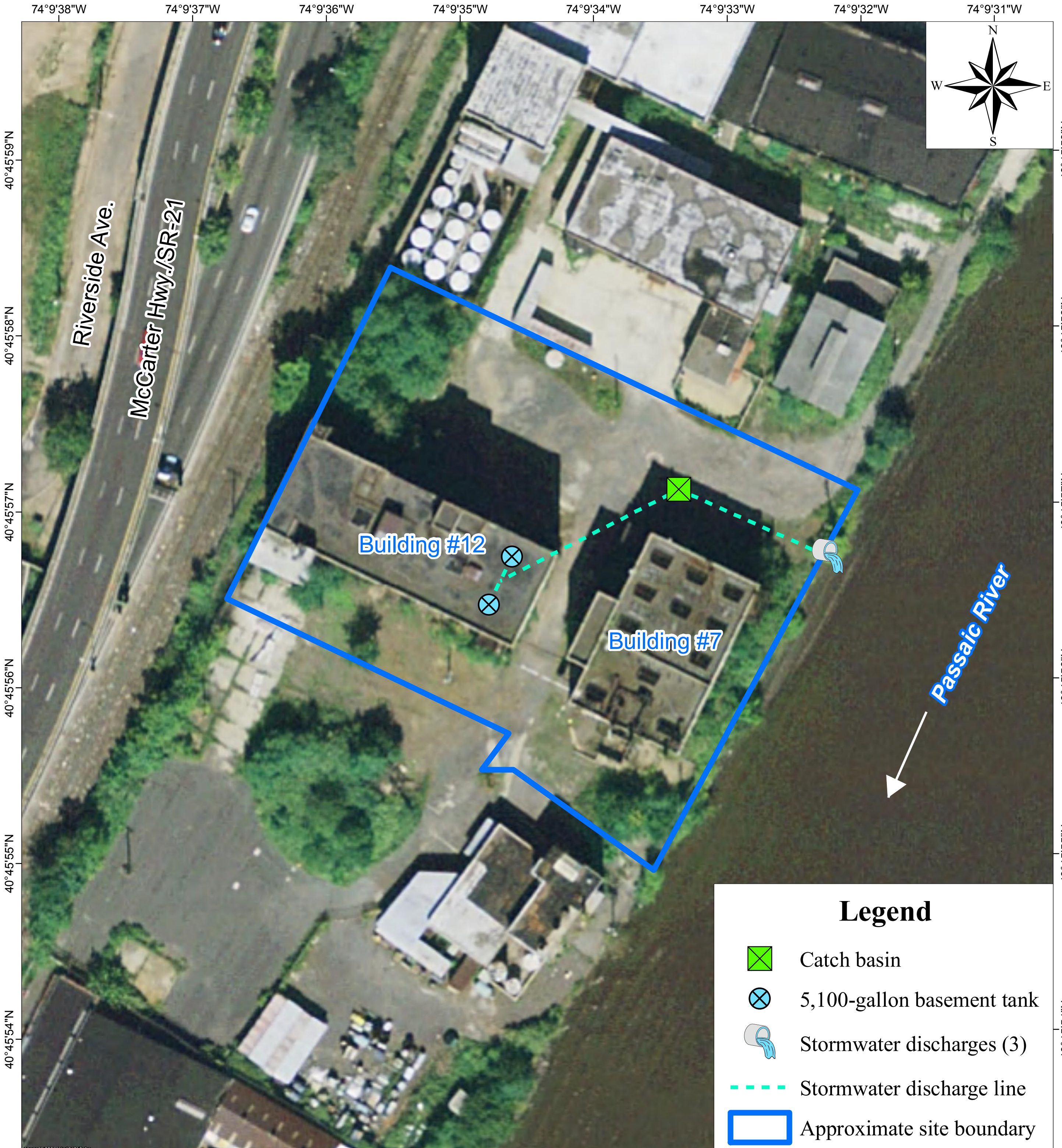
Figure 1
Site Location Map

Project number 9004L100178 EPA Contract No. EP-S7-06-01	Map created on April 14, 2010 by D. Call, Tetra Tech EM Inc.	TETRA TECH

City of Newark, NJ and is located at 1712 & 1712 - 1716 Riverside Avenue, in a former industrial area adjacent to the Passaic River. The approximately 1.48 acre site is bordered to the east by the Passaic River, to the west by the N/F Erie-Lackawanna Railroad and McCarter Highway, NJ Route 21, to the north and south by private buildings. The site is currently not in use and has been inactive since approximately 1993. Two multi-floored structures, identified as Building #7 (three-story) and Building #12 (five-story) are currently located on the site. Building #7 is located in the southern portion of the site, adjacent to the Passaic River. A current aerial view of the site can be seen on Figure 2, Site Layout Map.

2.2 SITE HISTORY

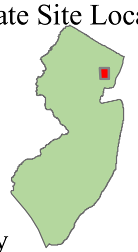
The site has been used for industrial activities since 1909. From 1909 through 1983, various operators utilized the property for the manufacture of paints and varnishes. From around 1931 through 1973, the property was a small part of a much larger facility owned and operated by Pittsburgh Paint & Glass Company. The property has been occupied by various operators from 1973 through 1993, when the current owner, the City of Newark obtained the property through foreclosure (Weston 2009).



Source: Modified from DigitalGlobe aerial photography, September 19, 2009.

0 50 100 Feet

Approximate Site Location =



New Jersey

29 Riverside Avenue
Newark, Essex County, New Jersey

Figure 2
Site Layout Map

Project number 9004L100178
EPA Contract No. EP-S7-06-01

Map created on April 14, 2010
by D. Call, Tetra Tech EM Inc.

TETRA TECH

2.3 PREVIOUS INVESTIGATIONS

In 2009, Weston Solutions was retained by the City of Newark Department of Economic Development and Housing to perform a preliminary assessment of the site. The preliminary assessment was completed to identify existing and/or potential areas of concern (AOC). Weston identified 11 AOCs during the preliminary assessment. After completion of the preliminary assessment, PMK Group, Inc. (Birdsall 2009) was retained by the Brick City Development Corporation to conduct an environmental site investigation (SI) for the property (Birdsall 2009). The SI was completed to address the conclusions and recommendations presented in the preliminary assessment report and to address issues regarding the planned redevelopment of the property, including the demolition of the two existing structures and site improvements including possibly the construction of a new facility. Given the site history, it was assumed that the SI would reveal environmental impacts above New Jersey Department of Environmental Protection (NJDEP) criteria; therefore, the SI strategy was to provide a “presence/absence” determination of environmental impacts expecting that an extensive remedial investigation would be required to delineate and define site conditions. Seven of these 11 AOCs identified in the preliminary assessment were investigated as part of the SI. The AOC’s identified in the preliminary assessment which were investigated in the SI are shown in Table 1 below.

TABLE 1

AREAS OF CONCERN SUMMARY

AOC Identifier	Description
AOC A-1	Above ground storage tanks and associated piping
AOC A-2	Underground storage tanks and associated piping
AOC A-3	Piping, above ground and below ground pumping stations, sumps and pits
AOC B-1	Storage pads; including drum & waste storage
AOC C-1	Floor drains, trenches and piping sumps
AOC D-1	Waste piles
AOC D-2	Open pipe discharges
AOC E-1	Electrical transformers & capacitors
AOC E-1A	Discolored or spill areas
AOC F-1	Loading or transfer areas
AOC G-1	Freight elevators

Notes: Shaded rows indicate AOCs that were investigated during SI.
AOC = Area of concern.

The SI field activities were completed between August and October 2009 and included a geophysical survey, collection of soil and groundwater samples and samples of basement water located within Building #7. The results of the geophysical survey indicated nine possible underground storage tanks (UST) located east of Building #12. Analytical results from soil samples collected from areas surrounding the identified AOCs indicated exceedances of NJDEP criteria for total petroleum hydrocarbons, volatile organic compounds (VOC), semivolatile organic compounds (SVOC), metals and polychlorinated biphenyls (PCBs). Two groundwater samples were collected from the site, one directly downgradient of AOC A-2 (location of USTs east of Building #12) and one collected west of Building #7, downgradient to AOC F-1 (the loading dock). Fingerprint analysis of the groundwater sample collected downgradient of AOC A-2 indicated the presence of mineral spirits and fuel oil No. 4. The groundwater sample collected downgradient of AOC F-1 indicated the presence of VOC, SVOC and metal exceedances of NJDEP groundwater quality criteria (GQC) for Class II-A aquifers. The basement water sampling results revealed VOCs, SVOCs, PCBs and metals exceeding the applicable NJDEP GQC for Class II-A aquifers.

PMK also investigated ten USTs identified east of Building #12. Nine out of the10 tanks contained either liquid or sludge, one tank contained soil. Samples collected from the USTs were analyzed for priority pollutants (PP +40). Results showed benzene (up to 169 micrograms per liter [ug/L]), ethylbenzene (up to 12,100 ug/L), toluene (up to 77,000 ug/L), total xylene (up to 25,700 ug/L), and 2-butanone (up to 17,000 ug/L).

On October 29, 2009, NJDEP responded to an oil spill that stretched for a ¼-mile in the Passaic River. The source of the spill was identified at low tide when a pipe leaking black, viscous oil was exposed. The pipe was traced back to two above ground storage tanks located on the site in the basement of Building #12. The tanks were connected directly to a sewer line that eventually discharged into the Passaic River. NJDEP requested assistance from EPA to respond to the spill. The EPA Emergency and Rapid Response (ERRS) contractor secured the tanks and sewer line in the basement of Building #12 to prevent further discharge. Field screening results indicated that the oil was No. 4 heating oil. An estimated 500-gallons of No. 4 heating oil was spilled into the Passaic River during this incident.

Tetra Tech performed a site visit at the Riverside Avenue Site on April 7, 2009. Tetra Tech was accompanied by Dwayne Harrington, EPA Federal On-Scene Coordinator (OSC). The purpose of the visit was to document current site conditions and identify potential sampling areas. The visit confirmed the existence of several AOCs located within Buildings # 7 and #12 that were identified in the preliminary assessment. Most of the areas within the two buildings were accessible; however, some of the stairwells within the buildings were in various states of disrepair and neglect and were deemed inaccessible. These areas were avoided, pending assessors' ability to obtain alternative, safe means of mechanical access for any future assessments.

3.0 OBJECTIVE AND DATA USE

The objective of this sampling event is to determine if hazardous substances are present in the following areas: (1) storage or process tanks located on the second and third floors of Building # 7, (2) waters and possibly residual solids that have collected in the basements of both Building #7 and Building # 12, (3) drums found on the site, (4) dry red and blue-colored pigment materials found on the fourth and fifth floors of Building #12. In addition, samples will be collected of any pipe insulation observed in the on-site buildings to determine if asbestos-containing materials (ACM) are present.

4.0 PROPOSED ACTIVITIES

This section describes the scope of work; project personnel; methods and procedures for sample collection, sample handling, and delivery to the approved laboratory; and equipment decontamination procedures.

4.1 SCOPE OF WORK

Tetra Tech will complete the following tasks during this sampling event:

- Collect up to 25 liquid and/or residual solid samples from any tanks located on the second and third floors of Building #7 and perform preliminary field hazard screening tests. Field screening will consist of testing for flammability, reactivity, corrosivity, water solubility and the presence of oxidizers or cyanide.

- Collect up to two aqueous and, if present two residual solid samples from the basements of Buildings #7 and 12 where pooled water has accumulated.
- Perform inventory and sampling of any drums located on site and perform preliminary field hazard screening tests on any liquids present in the drums. Field screening will consist of testing for flammability, reactivity, corrosivity, water solubility and the presence of oxidizers or cyanide.
- Collect up to two samples of the red and blue-colored dry pigment materials located on the floors of Building #12.
- Obtain no more than 12 bulk asbestos samples from the pipe insulation located on site.
- Collect trip and field blanks for quality assurance (QA) and quality control (QC) purposes.
- Photo document sampling activities and sampling locations and record all sampling locations with a global positioning system.
- Package and ship samples to a laboratory procured through the EPA contract laboratory program (CLP) for target compound list (TCL) VOCs, SVOCs, pesticides, and PCBs and target analyte list (TAL) metals and cyanide. Samples from the drums and tanks will be submitted to a laboratory for Resource Conservation and Recovery Act (RCRA) characteristics analysis and toxicity characteristics leaching procedure (TCLP) analysis for VOCs, herbicides, pesticides and metals.
- Submit a trip report describing all field activities and summarizing validated analytical data obtained during the investigation.

4.2 SAMPLE COLLECTION

This section describes the proposed sampling activities and summarizes the sampling locations and sampling methods to be used at the site. All sample identifiers will be designated in accordance with the following format:

RAS-BW-XX

The “RAS” prefix refers to the site name – Riverside Avenue Site. The “BW” portion refers to the sample matrix (“BW” for basement water, “BS” for basement solid, “TM” for tank material, “PM” for pigment material, “PACM” for potential asbestos-containing material, “DM” for drum material sample, “TB” for trip blank and “FB” for field blank). The “XX” portion of the suffix refers to the unique sample number assigned at a specific sampling location.

4.2.1 Tank and Drum Inventory and Sampling

Tetra Tech will use a simple numbering system to inventory each tank located on the second and third floor of Building #7 and any drums located on the site. Tetra Tech will open each tank or drum and record VOC measurements using a photoionization detector (PID) and record the measurements in the site logbook. Tetra Tech will determine if liquid or residual solids are present in each tank or drum. If present, a liquid sample will be collected in accordance with Tetra Tech Standard Operating Procedure (SOP) 008 “Containerized Liquid, Sludge, and Slurry Sampling” (Tetra Tech 2000a) and preliminary field hazard screening tests will be performed. Field screening will consist of testing for flammability, reactivity, corrosivity, water solubility and the presence of oxidizers or cyanide. Based on the results of the field screening tests liquid and/or solid samples from the drums or tanks may be collected for submission to the CLP laboratory for RCRA characteristics analysis (ignitability, corrosivity, reactivity) and TCLP analysis for VOCs, herbicides, pesticides and metals. Samples from drums or tanks containing similar substances may be composited into one sample for laboratory analysis. Up to five drum samples will be collected and up to 25 tank samples will be collected; the exact number of samples to be obtained will be determined based on the results of the initial field screening tests. Tetra Tech will record the time the sample was collected, the location of the sample, and a description of the sample in the logbook. Each tank will be marked after the sample is collected with the sample identification and analysis performed.

4.2.2 Buildings # 7 and # 12 Basement Sampling

Pooled water was observed in the basements of Buildings #7 and #12 during the April 2009 site visit. Tetra Tech will collect up to two aqueous samples of this pooled water to determine if hazardous substances are present. Tetra Tech will collect the aqueous samples by submerging the bottleware below the surface of the water in accordance with SOP No. 009, “Surface Water Sampling” (Tetra Tech 2009a). If present, Tetra Tech will also collect up to two samples of any residual solid material located on the floor of the basements in accordance with Tetra Tech SOP No. 006 “Sludge and Sediment Sampling” (Tetra Tech 2000b). The solid samples will be collected with a hand corer. The aqueous and solid samples will be submitted to the CLP laboratory for TCL VOCs, SVOCs, pesticides and PCBs analysis and TAL metals and cyanide analysis.

4.2.3 Sampling of Red and Blue-Colored Pigments Located in Building #12

Tetra Tech will collect up to two samples of the red and blue-colored pigments observed on the floors of Building #12. The samples will be collected in accordance with Tetra Tech SOP No. 006 “Sludge and Sediment Sampling” (Tetra Tech 2000b). The samples will be submitted to the CLP laboratory for TCL SVOCs, TAL metals and cyanide analysis.

4.2.4 Asbestos-Form and Potential Asbestos Containing Material Sampling

Tetra Tech will collect no more than 12 bulk samples from pipe insulation contained in both Buildings # 7 and # 12. Tetra Tech will collect bulk samples through a glove bag, in accordance with Code of Federal Regulations Title 40, Part 763.86 “Asbestos Sampling” (EPA 1987). The sample points on the insulation will be wetted with amended water and a section no greater than 3 square inches will be removed from the sample point and placed in a sample jar. The sample will then be removed from the glove bag by placing it in the glove, pulling the glove inside out, taping the glove and cutting it away from the glove bag with scissors. The glove bag will be wrapped and secured to the pipe with tape around the sampling point and the sample cutting equipment will be disposed. Disposable sampling equipment will be utilized at each sampling point in order to minimize the spread of asbestos fibers and cross-contamination.

4.3 SAMPLING SUMMARY

Table 1 summarizes the sample identifiers, matrices, locations, and field QA/QC descriptions for the sampling event. Exact sample locations will be determined in the field based on conditions encountered and observations noted at the time of the sampling event.

TABLE 2

SAMPLING SUMMARY

Sample Identifier	Sample Matrix	Sampling Location	Rationale
RAS-PACM-01 through RAS-PACM-12	Insulation	Pipes located within Buildings # 7 and/or # 12	Determine if insulation contains asbestos.
RAS-BW-01 through RAS-BW-02	Water	Aqueous samples from the standing water located in Buildings # 7 and #12 basements.	Determine presence of hazardous substances and characterize for disposal.
RAS-BS-01 through RAS-BS-02	Sediment	Solid samples from the sediments located in Buildings # 7 and #12 basements.	Determine presence of hazardous substances and characterize for disposal.
RAS-TM-01 through RAS-TM-25	Liquid / Solid	Sample collected of any liquid or solid present in the tanks located in Building #7	Determine presence of hazardous substances and characterize for disposal.
RAS-PM-01 Through RAS-PM-02	Solid	Solid samples collected of the red and blue-colored pigments found on the 4th and 5th floors of Building #12	Determine presence of hazardous substances and characterize for disposal.
RAS-DM-01 through RAS-DM-05	Liquid / Solid	Grab samples from on-site drums.	Determine presence of hazardous substances and characterize for disposal.
RAS-TB-01	Aqueous	Trip blank	QA/QC
RAS-FB-01	Aqueous	Field blank	QA/QC

4.4 KEY PROJECT PERSONNEL

The Tetra Tech project manager for the technical direction document (TDD) is Kevin Scott. Mr. Scott will be responsible and accountable for all aspects of the project scope of work, including achieving the technical, financial, and scheduling objectives for the project. Mr. Scott will communicate directly with the EPA Work Assignment Manager (WAM) for this project, Mr. Dwayne Harrington. Other Tetra Tech personnel proposed for the project are presented in Table

2. The technical or field support personnel working on the project may vary depending on the specific needs of the project, as well as on-site conditions and availability of staff.

TABLE 3

PROPOSED TETRA TECH PROJECT PERSONNEL

Project Function	Name	Role
Project Manager	Kevin Scott	Responsible for implementing all activities identified in the TDD; responsible for developing and implementing the site health and safety plan; has authority to commit resources necessary to complete the work; prepares deliverables required by the TDD; communicates directly with the EPA WAM, the project team, and any other personnel needed to complete the project.
Field Support Personnel	Steven Morpus and Chris Burns	Performs necessary sampling or monitoring, as well as other tasks defined in the TDD or assigned by the EPA WAM or the Tetra Tech project manager; communicates directly with the Tetra Tech project manager and, when appropriate, the EPA WAM.
Health and Safety Officer	Chris Draper	Oversees and supports development of the site health and safety plan; communicates directly with the Tetra Tech project manager to ensure that all corporate health and safety protocols applicable to the site are being followed.
Chemist	Josh Cope	Coordinates with the Tetra Tech project manager regarding the analytical requirements for the project; solicits and procures necessary laboratory services; reviews and validates analytical data, if necessary; communicates directly with the Tetra Tech project manager, field support personnel, EPA WAM, and START program manager as necessary.
Graphics and Mapping Specialist	Dan Call	Generates maps and other figures for project deliverables or presentations; assists the Tetra Tech project manager or other personnel when global positioning system activities are required.
Financial Manager	Bob Rynkar	Works with the Tetra Tech project manager in planning related to the TDD budget and completion date; enters financial information on the project into the Tetra Tech management information system; prepares regular and special reports to assist the Tetra Tech project manager in managing the project.
Quality Assurance Manager	Andy Mazzeo	Responsible for all quality assurance/quality control aspects of the START contract.

Notes:
EPA = U.S. Environmental Protection Agency
START = Superfund Technical Assessment and Response Team
TDD = Technical Direction Document
Tetra Tech = Tetra Tech EM Inc.
WAM = Work Assignment Manager

4.5 SAMPLE HANDLING

Sample handling, packaging, and shipment procedures will be conducted in accordance with Tetra Tech SOP No. 019, “Packaging and Shipping Samples” (Tetra Tech 2008a). All samples will be shipped to the CLP laboratory assigned by EPA Region 2. All sampling data, including sample time, date, location, type, and sampler, will be recorded on Forms2Lite chain-of-custody and traffic reports and in the site logbook in accordance with Tetra Tech SOP No. 024, "Recording of Notes in Field Logbook" (Tetra Tech 2008b). The Tetra Tech project manager will assure that sample quality and integrity are maintained in accordance with Tetra Tech's Quality Assurance Project Plan (QAPP) for START (Tetra Tech 2006).

4.6 EQUIPMENT DECONTAMINATION

Dedicated sampling equipment and personal protective equipment (PPE) will be double-bagged and disposed of with all other used PPE waste produced at the site. Non-dedicated sampling equipment will undergo a gross decontamination with Alconox and distilled water followed by a double rinse with distilled water, in accordance with Tetra Tech SOP No. 002, "General Equipment Decontamination" (Tetra Tech 2009b). All investigation-derived waste (IDW) will be double-bagged and disposed of as dry industrial waste.

5.0 ANALYTICAL PARAMETERS

The aqueous and solid samples collected from the drums, tanks, and basements of Buildings #7 and 12 will be analyzed for TCL VOCs, SVOCs, pesticides, PCBs, and TAL metals and total cyanide by the assigned EPA CLP laboratory. The samples of the red and blue-colored pigments will be analyzed for TAL metals and cyanide only. PACM samples will be analyzed for the presence of asbestos-form fibers using EPA 600-R-93-116 "Method for the Determination of Asbestos in Bulk Building Materials using Polarized Light Microscopy" and EPA Method 600/R-93/116 Section 2.5 (Transmission Electron Microscopy (TEM) Percent by Mass). Table 3 summarizes analytical parameters, including the sample matrix, analytical parameter, analytical method, sample containers and preservatives, detection limits, and maximum holding times for the samples proposed for collection during this sampling event.

TABLE 4

ANALYTICAL PARAMETERS AND METHODS

Matrix	Analysis	Analytical	Container	Preservative	Detection	Maximum

		Method	(per location)		Limit	Holding Time
Aqueous	VOC	CLP SOW OLM 04.3	Three 40-mL vials	HCl pH<2 and ice	CRQL	14 days
	SVOC Pesticide/PCBs	CLP SOW OLM 04.3	Four 1-L ambers	Ice	CRQL	SVOC, PCBs, and pesticides – 7 days to extraction, 40 days to analysis
Solid	VOC	CLP SOW OLM 04.3	One 4-ounce jar with septum	Ice	CRQL	14 days
	SVOC Pesticide/PCBs	CLP SOW OLM 04.3	One 8-ounce jar	Ice	CRQL	SVOC, PCBs, and pesticides – 7 days to extraction, 40 days to analysis
	Metals Cyanide	CLP SOW ILM 05.4 ICPAES+Hg+CN	One 8-ounce jar	Ice	CRDL	180 days for all metals (except mercury – 28 days; cyanide –12 days)
Drum Tank Samples	RCRA Hazardous Waste Characterization (TCLP VOCs, SVOCs, herbicides, pesticides and metals)	EPA Method 1311 Corrosivity, Flashpoint, Reactivity	One 8-ounce jar	Ice	CRQL CRDL	14 days

CLP = Contract Laboratory Program
CN = Cyanide
CRDL = Contract-required detection limit
CRQL = Contract-required quantitation limit
HCl = Hydrochloric acid
Hg = Mercury
ICPAES = Inductively coupled plasma atomic emission spectroscopy
ILM = Inorganic low to medium
L = Liter
mL = Milliliter
NaOH = Sodium hydroxide
PCB = Polychlorinated biphenyl
RCRA = Resource Conservation and Recovery Act
SOM = Superfund Organic Method
SOW = Statement of Work
SVOC = Semivolatile organic compound
TCLP = Toxicity Characteristic Leaching Procedure
VOC = Volatile organic compound

6.0 QUALITY ASSURANCE AND QUALITY CONTROL PROCEDURES

This section describes the QA/QC procedures for personnel during the site sampling event, including responsibilities, field QC, laboratory QC, and data validation and evaluation and management.

6.1 RESPONSIBILITY

The Tetra Tech project manager, Kevin Scott will be responsible for ensuring that sample quality and integrity are maintained in accordance with Tetra Tech's QAPP for START (Tetra Tech 2006).

6.2 FIELD QUALITY CONTROL

Each sampling location will be noted in the site logbook in accordance with Tetra Tech SOP No. 024, "Recording of Notes in Field Logbook" (Tetra Tech 2008b). Field and trip blank samples will be collected to verify that the samples were properly handled during sample collection, sample shipment, and laboratory analysis.

6.3 LABORATORY QUALITY CONTROL

Samples will be shipped to the EPA CLP laboratory assigned by EPA Region 2. Laboratory QC measures will consist of all QC elements identified in the laboratory procurement Statement of Work (SOW) and will include completion of all forms and deliverables required in the SOW.

6.4 DATA VALIDATION

All analytical data will be validated in accordance with EPA Region 2 CLP SOW functional guidelines for data review.

6.5 DATA EVALUATION AND MANAGEMENT

This section describes how Tetra Tech will: (1) evaluate the data generated from the sampling event, (2) determine whether the data are representative of site conditions and collect enough for use in making confident risk management decisions, and (3) ensure that the data are secure and retrievable.

6.5.1 Data Evaluation

Tetra Tech will review the analytical package to determine whether any major deficiencies were encountered during analysis and to ensure that the data are interpreted correctly. The data gathered during this sampling event will be forwarded to the EPA WAM for further evaluation. The data will be presented by Tetra Tech to the EPA in the form of a trip report that summarizes field activities and analytical data obtained from the sampling and analysis described in this SAP.

6.5.2 Data Representativeness and Completeness

This SAP is designed to obtain data representative of site conditions. If sampling activities vary significantly from this plan because of unexpected conditions in the field or other unforeseeable factors, Tetra Tech will discuss how those variations affect data representativeness with the EPA WAM and will include a discussion of the matter in the trip report.

6.5.3 Data Management

Tetra Tech will request that the laboratory submit the analytical data in electronic form as well as in the required hard copy analytical data package. Tetra Tech will compare the electronic data deliverables with the hard copy data package to ensure their consistency. When the Tetra Tech chemist has approved the data set with the appropriate data qualifiers, the electronic data will be released to the Tetra Tech project manager for reporting. Tetra Tech will use the data to prepare the trip report for the project. All electronic data will be stored in a Microsoft (MS) Excel or Access database for future retrieval and reference based on the WAM's requirements. If the analytical data are not available from the laboratory in electronic form, Tetra Tech will manually enter the data into an MS Excel or Access database. Each hard copy data package will be kept in the project file in the Tetra Tech office in Boothwyn, Pennsylvania, until the data package is officially transferred to EPA.

7.0 DELIVERABLES

When sampling and the appropriate QA/QC procedures are complete, Tetra Tech will submit a draft trip report to EPA that summarizes field activities and the analytical results obtained from this sampling event.

8.0 SCHEDULE

The project schedule for this site removal assessment is provided below in Table 4.

TABLE 5

PROJECT SCHEDULE

Task	Completion Time Frame
Conduct site visit	April 7, 2010
Submit Draft SAP	April 22, 2010
Submit Final SAP	May 4, 2010
Develop site health and safety plan	May 6, 2010
Mobilize to site to conduct sampling activities	To be determined
Draft Trip Report	One month after receipt of validated analytical data

9.0 REFERENCES

Birdsall Services Group Inc./PMK Group, Inc. Draft Site Investigation Report. 1700-1712 & 1702-1716 McCarter Highway. Block 614, Lots 63 and 64. PMK Group #092976. October 16, 2009.

Environmental Protection Agency (EPA). Code of Federal Regulations Title 40, Part 763.86 "Asbestos Sampling" Oct. 30, 1987.

Tetra Tech EM Inc. (Tetra Tech). "Containerized Liquid, Sludge, or Slurry Sampling." SOP No. 008. January 2000a.

Tetra Tech. "Sludge and Sediment Sampling." SOP No. 006. January 2000b.

Tetra Tech. "Quality Assurance Project Plan (QAPP) for START." Boothwyn, Pennsylvania. November 2006.

Tetra Tech. "Packaging and Shipping Samples." SOP No. 019. December 2008a.

Tetra Tech. "Recording of Notes in Field Logbooks." SOP No. 024. December 2008b.

Tetra Tech. "Surface Water Sampling." SOP No. 009. June 2009a.

Tetra Tech. "General Equipment Decontamination." SOP No. 002. Revision No. 3. June 2009b.

Tetra Tech. Site Reconnaissance Field Notes. April 7, 2010.

United States Geological Survey. 7.5-Minute Series Topographic Map for Elizabeth, New Jersey, 1981 and Orange, New Jersey, 1981.

Weston Solutions, Inc. Preliminary Assessment Report. 1700-1712 & 1702-1716 McCarter Highway. May 2009

APPENDIX A

TETRA TECH STANDARD OPERTING PROCEDURES

SOP APPROVAL FORM

TETRA TECH EM INC.

ENVIRONMENTAL STANDARD OPERATING PROCEDURE

GENERAL EQUIPMENT DECONTAMINATION

SOP NO. 002

REVISION NO. 3

Last Reviewed: June 2009

R Riesing

Quality Assurance Approved

6-19-09

Date

1.0 BACKGROUND

All nondisposable field equipment must be decontaminated before and after each use at each sampling location to obtain representative samples and to reduce the possibility of cross-contamination.

1.1 PURPOSE

This standard operating procedure (SOP) establishes the requirements and procedures for decontaminating equipment in the field.

1.2 SCOPE

This SOP applies to decontaminating general nondisposable field equipment. To prevent contamination of samples, all sampling equipment must be thoroughly cleaned prior to each use.

1.3 DEFINITIONS

Alconox: Nonphosphate soap, obtained in powder detergent form and dissolved in water

Liquinox: Nonphosphate soap, obtained in liquid form for mixing with water

1.4 REFERENCES

U.S. Environmental Protection Agency (EPA). 1992a. "Guide to Management of Investigation-Derived Wastes." Office of Solid Waste and Emergency Response. Washington D.C. EPA 9345.3-03FS. January.

EPA. 1992b. "RCRA Ground-Water Monitoring: Draft Technical Guidance." Office of Solid Waste. Washington, DC. EPA/530-R-93-001. November.

EPA. 1994. "Sampling Equipment Decontamination." Environmental Response Team SOP #2006 (Rev. #0.0, 08/11/94). http://www.ert.org/mainContent.asp?section=Products&subsection=List

1.5 REQUIREMENTS AND RESOURCES

The equipment required to conduct decontamination is as follows:

- Scrub brushes
- Large wash tubs or buckets
- Squirt bottles
- Alconox or Liquinox
- Tap water
- Distilled water
- Plastic sheeting
- Aluminum foil
- Methanol or hexane
- Isopropanol (pesticide grade)
- Dilute (0.1 N) nitric acid

2.0 PROCEDURE

The procedures below discuss decontamination of personal protective equipment (PPE), drilling and monitoring well installation equipment, borehole soil sampling equipment, water level measurement equipment, general sampling equipment, and groundwater sampling equipment.

2.1 PERSONAL PROTECTIVE EQUIPMENT DECONTAMINATION

Personnel working in the field are required to follow specific procedures for decontamination prior to leaving the work area so that contamination is not spread off site or to clean areas. All used disposable protective clothing, such as Tyvek coveralls, gloves, and booties, will be containerized for later disposal. Decontamination water will be containerized in 55-gallon drums (refer to Section 3.0).

Personnel decontamination procedures will be as follows:

1. Select an area removed from sampling locations that is both downwind and downgradient. Decontamination must not cause cross-contamination between sampling points.

2. Maintain the same level of personal protection as was used for sampling.

3. Wash neoprene boots (or neoprene boots with disposable booties) with Liquinox or Alconox solution and rinse with clean water. Remove booties and retain boots for subsequent reuse.

4. Wash outer gloves in Liquinox or Alconox solution and rinse in clean water. Remove outer gloves and place into plastic bag for disposal.

5. Remove Tyvek or coveralls. Containerize Tyvek for disposal and place coveralls in plastic bag for reuse.

6. Remove air purifying respirator (APR), if used, and place the spent filters into a plastic bag for disposal. Filters should be changed daily or sooner depending on use and application. Place respirator into a separate plastic bag after cleaning and disinfecting.

7. Remove disposable gloves and place them in plastic bag for disposal.

8. Thoroughly wash hands and face in clean water and soap.

2.2 DRILLING AND MONITORING WELL INSTALLATION EQUIPMENT DECONTAMINATION

All drilling equipment should be decontaminated at a designated location on site before drilling operations begin, between borings, and at completion of the project. Decontamination may be conducted on a temporary decontamination pad constructed at satellite locations within the site area in support of temporary work areas. The purpose of the decontamination pad is to contain wash waters and potentially contaminated soil generated during decontamination procedures. Decontamination pads may be constructed of concrete, wood, or plastic sheeting, depending on the site-specific needs and plans. Wash waters and contaminated soil generated during decontamination activities should be considered contaminated and thus, should be collected and containerized for proper disposal.

Monitoring well casing, screens, and fittings are assumed to be delivered to the site in a clean condition. However, they should be steam cleaned and placed on polyethylene sheeting on-site prior to placement downhole. The drilling subcontractor will typically furnish the steam cleaner and water.

The drilling auger, bits, drill pipe, any portion of drill rig that is over the borehole, temporary casing, surface casing, and other equipment used in or near the borehole should be decontaminated by the drilling subcontractor as follows:

1. Select an area removed from sampling locations that is both downwind and downgradient. Decontamination must not cause cross-contamination between sampling points.
2. Maintain the same level of personal protection as was used for sampling.
3. Remove loose soil using shovels, scrapers, wire brush, etc.
4. Steam clean or pressure wash to remove all visible dirt.
5. If equipment has directly or indirectly contacted contaminated media and is known or suspected of being contaminated with oil, grease, polynuclear aromatic hydrocarbons (PAH), polychlorinated biphenyls (PCB), or other hard to remove organic materials, rinse equipment with pesticide-grade isopropanol.
6. To the extent possible, allow components to air dry.
7. Wrap or cover equipment in clear plastic until it is time to be used.
8. All wastewater from decontamination procedures should be containerized.

2.3 BOREHOLE SOIL SAMPLING DOWNHOLE EQUIPMENT DECONTAMINATION

All soil sampling downhole equipment should be decontaminated before use and after each sample as follows:

1. Select an area removed from sampling locations that is both downwind and downgradient. Decontamination must not cause cross-contamination between sampling points.
2. Maintain the same level of personal protection as was used for sampling.
3. Prior to sampling, scrub the split-barrel sampler and sampling tools in a wash bucket or tub using a stiff, long bristle brush and Liquinox or Alconox solution.
4. After sampling, steam clean the sampling equipment over the rinsate tub and allow to air dry.
5. Place cleaned equipment in a clean area on plastic sheeting and wrap with aluminum foil.
6. Containerize all water and rinsate; disposable single-use sampling equipment should also be containerized.
7. Decontaminate all equipment placed down the hole as described for drilling equipment.

2.4 WATER LEVEL MEASUREMENT EQUIPMENT DECONTAMINATION

Field personnel should decontaminate the well sounder and interface probe before inserting and after removing them from each well. The following decontamination procedures should be used:

1. Select an area removed from sampling locations that is both downwind and downgradient. Decontamination must not cause cross-contamination between sampling points.

2. Maintain the same level of personal protection as was used for sampling.

3. Wipe the tape and probe with a disposable Alconox- or Liquinox-impregnated cloth or paper towel.

4. If immiscible layers are encountered, the interface probe may require steam cleaning or washing with pesticide-grade isopropanol.

5. Rinse with deionized water.

2.5 GENERAL SAMPLING EQUIPMENT DECONTAMINATION

All nondisposable sampling equipment should be decontaminated using the following procedures:

1. Select an area removed from sampling locations that is both downwind and downgradient. Decontamination must not cause cross-contamination between sampling points.

2. Maintain the same level of personal protection as was used for sampling.

3. To decontaminate a piece of equipment, use an Alconox wash; a tap water wash; a solvent (isopropanol, methanol, or hexane) rinse, if applicable, or dilute (0.1 N) nitric acid rinse, if applicable; a distilled water rinse; and air drying. Use a solvent (isopropanol, methanol, or hexane) rinse for grossly contaminated equipment (for example, equipment that is not readily cleaned by the Alconox wash). The dilute nitric acid rinse may be used if metals are the analyte of concern.

4. Place cleaned equipment in a clean area on plastic sheeting and wrap with aluminum foil.

5. Containerize all water and rinsate.

2.6 GROUNDWATER SAMPLING EQUIPMENT

The following procedures are to be employed for the decontamination of equipment used for groundwater sampling. Decontamination is not necessary when using disposable (single-use) pump tubing or bailers. Bailer and downhole pumps and tubing decontamination procedures are described in the following sections.

2.6.1 Bailers

1. Select an area removed from sampling locations that is both downwind and downgradient. Decontamination must not cause cross-contamination between sampling points.

2. Maintain the same level of personal protection as was used for sampling.

3. Evacuate any purge water in the bailer.

4. Scrub using soap and water and/or steam clean the outside of the bailer.

5. Insert the bailer into a clean container of soapy water. Thoroughly rinse the interior of the bailer with the soapy water. If possible, scrub the inside of the bailer with a scrub brush.

6. Remove the bailer from the container of soapy water.

7. Rinse the interior and exterior of the bailer using tap water.

8. If groundwater contains or is suspected to contain oil, grease, PAH, PCB, or other hard to remove organic materials, rinse equipment with pesticide-grade isopropanol.

9. Rinse the bailer interior and exterior with deionized water to rinse off the tap water and solvent residue, as applicable.

10. Drain residual deionized water to the extent possible.

11. Allow components to air dry.

12. Wrap the bailer in aluminum foil or a clean plastic bag for storage.

13. Containerize the decontamination wash waters for proper disposal.

2.6.2 Downhole Pumps and Tubing

1. Select an area removed from sampling locations that is both downwind and downgradient. Decontamination must not cause cross-contamination between sampling points.

2. Maintain the same level of personal protection as was used for sampling.

3. Evacuate any purge water in the pump and tubing.

4. Scrub using soap and water and/or steam clean the outside of the pump and, if applicable, the pump tubing.

5. Insert the pump and tubing into a clean container of soapy water. Pump/run a sufficient amount of soapy water to flush out any residual well water. After the pump and tubing are flushed, circulate soapy water through the pump and tubing to ensure that the internal components are thoroughly flushed.

6. Remove the pump and tubing from the container.

7. Rinse external pump components using tap water.

8. Insert the pump and tubing into a clean container of tap water. Pump/run a sufficient amount of tap water through the pump to evacuate all of the soapy water (until clear).

9. If groundwater contains or is suspected to contain oil, grease, PAH, PCB, or other hard to remove organic materials, rinse the pump and tubing with pesticide-grade isopropanol.

10. Rinse the pump and tubing with deionized water to flush out the tap water and solvent residue, as applicable.

11. Drain residual deionized water to the extent possible.

12. Allow components to air dry.

13. For submersible bladder pumps, disassemble the pump and wash the internal components with soap and water, rinse with tap water, isopropanol (if necessary), and deionized water, and allow to air dry.

14. Wrap pump and tubing in aluminum foil or a clean plastic bag for storage.

15. Containerize the decontamination wash waters for proper disposal.

3.0 INVESTIGATION-DERIVED WASTE

Investigation-derived waste (IDW) can include disposable single-use PPE and sampling equipment, soil cuttings, and decontamination wash waters and sediments. Requirements for waste storage may differ from one facility to the next. Facility-specific directions for waste storage will be provided in project-specific documents, or separate direction will be provided by the project manager. The following guidelines are provided for general use:

1. Assume that all IDW generated from decontamination activities contains the hazardous chemicals associated with the site unless there are analytical or other data to the contrary. Waste solution volumes could vary from a few gallons to several hundred gallons in cases where large equipment required cleaning.

2. Containerized waste rinse solutions are best stored in 55-gallon drums (or equivalent containers) that can be sealed until ultimate disposal at an approved facility.

3. Label IDW storage containers with the facility name and address, date, contents, company generating the waste, and an emergency contact name and phone number.

4. Temporarily store the IDW in a protected area that provides access to the containers and allows for spill/leak monitoring, sampling of containers, and removal following determination of the disposal method.

SOP APPROVAL FORM

TETRA TECH EM INC.

ENVIRONMENTAL STANDARD OPERATING PROCEDURE

SLUDGE AND SEDIMENT SAMPLING

SOP NO. 006

REVISION NO. 3

Last Reviewed: January 2000

RRiesing

Quality Assurance Approved

May 18, 1993

Date

1.0 BACKGROUND

Sludges are semisolid materials ranging from dewatered solids to high-viscosity liquids. Sludges generally accumulate as residuals of water-bearing waste treatment or industrial process systems. Sludges typically accumulate in tanks, drums, impoundments, or other types of containment systems.

Sediments generally are materials deposited in surface impoundments or in natural waterways such as lakes, streams, and rivers.

1.1 PURPOSE

This standard operating procedure (SOP) establishes the requirements and procedures for sampling sludge in open drums and shallow tanks (3 feet deep or less) and sediment in lakes, streams, and rivers.

1.2 SCOPE

This SOP applies to collection of sludge and sediment samples. It provides detailed procedures for gathering such samples with specific equipment.

1.3 DEFINITIONS

Gravity Corer: Metal tube with a tapered nosepiece on the bottom and a check valve on the top. The nosepiece reduces core disturbance during penetration. The check valve allows air and water to pass through the sampler during deployment and prevents sample loss (washout) during retrieval.

Hand Corer: Thin-wall metal tube with a tapered nosepiece, a “T” handle to facilitate sampler deployment and retrieval, and a check valve on top.

Ponar Grab Sampler: A clamshell-type metal scoop activated by a counter-lever latching system.

1.4 REFERENCES

American Public Health Association. 1975. "Standard Methods for the Examination of Water and Wastewater." 14th Edition. Washington DC.

U.S. Environmental Protection Agency (EPA). 1984. "Characterization of Hazardous Waste Sites -- A Methods Manual. Volume II -- Available Sampling Methods." Second Edition. EPA-600/A-84-076. December.

EPA. 1994. "Sediment Sampling." Environmental Response Team SOP #2016 (Rev. #0.0, 11/17/94). On-Line Address: http://204.46.140.12/media_resrcs/media_resrcs.asp?Child1=

1.5 REQUIREMENTS AND RESOURCES

The selection of sampling equipment and procedures should be based on project objectives and site-specific conditions such as the type and volume of sludge or sediment to be sampled, sampling depth, and the type of sample required (disturbed or undisturbed). The selected sampling equipment should be constructed of inert materials that will not react with the sludge or sediment being sampled.

The following equipment may be required to sample sludge or sediment:

- Plastic sheeting
- Field logbook
- Spoons or spatulas
- Stainless-steel scoop or trowel
- Gravity corer
- Ponar grab sampler
- Stainless-steel or Teflon® tray
- Hand corer
- Nylon rope
- Sample containers and labels
- Chain-of-custody and shipping materials
- Decontamination materials

2.0 PROCEDURES

This section provides general procedures for sampling sludge and sediment. Sections 2.1 through 2.4 specify the methods and equipment to be used for such sampling.

Sludge Sampling

Sludge can often be sampled using a stainless-steel scoop or trowel (see Section 2.1). Frequently sludge forms when components with higher densities settle out of a liquid. When this happens, the sludge may still have an upper liquid layer above the denser components. When the liquid layer is sufficiently shallow, the sludge may be sampled using a hand corer (see Section 2.2). Use of the hand corer is preferred because it results in less sample disturbance. The hand corer also allows for the collection of an aliquot of the overlying liquid. This prevents drying or excessive oxidation of a sample before analysis. The hand corer may also be adapted to hold a brass, polycarbonate plastic, or Teflon® liner.

A gravity corer may also be used to collect samples of most sludges and sediments (see Section 2.3). A gravity corer is capable of collecting an undisturbed sample that profiles the strata present in a sludge or sediment. Depending on the weight of the gravity corer and the density of the sludge or sediment, a gravity corer may penetrate the material up to 30 inches. If the layer is shallow (less than 1 foot), gravity corer and hand corer penetration may damage any underlying liner or confining layer. In such situations, a Ponar grab sampler may be used because it is generally capable of penetrating only a few inches (see Section 2.4).

Sediment Sampling

Sediment can be sampled in much the same manner as sludge; however, a number of additional factors must be considered. In streams, lakes, and impoundments, for instance, sediment is likely to demonstrate significant variations in composition.

For stream sediment sampling, the sampling location farthest downstream should be sampled first. Sediment samples collected in upstream and downstream locations should be obtained in similar depositional environments and, whenever possible, should be obtained from slow-moving pools. In addition, a sediment sample should be collected at approximately the same location as an associated aqueous sample. Aqueous samples should be obtained first to avoid collecting suspended particles that may result from sediment sampling. To avoid disturbing an area to be sampled, sampling locations in streams should always be approached from the downstream side.

Sediment samples collected from lakes and impoundments should also be collected at approximately the same locations as associated aqueous samples. As in stream sampling, aqueous samples should be collected first to avoid collecting suspended particles that may result from sediment sampling. Downgradient and background samples should be collected from similar depositional environments.

Exact sampling locations should be documented in field logbooks or on data sheets with respect to fixed reference points. In addition, the presence of rocks, debris, or organic material in the sludge or sediment to be sampled may preclude use or require modification of sampling equipment.

The following subsections specify methods for sludge or sediment sampling with specific equipment.

2.1 SAMPLING WITH A SCOOP OR TROWEL

Sludge or sediment samples may be collected with a simple scoop or trowel. This method is more applicable to sludge but can also be used for sediments, provided that the water is very shallow (a few inches). However, using a scoop or trowel may disrupt the water-sediment interface and cause substantial sample alteration. This method provides a simple, quick means of collecting a disturbed sample of sludge or sediment.

The following procedure can be used for sampling sludge or sediment with a scoop or trowel:

1. Place all sampling equipment on plastic sheeting next to the sampling location. Sample containers should be selected in accordance with the requirements in SOP No. 016, Sample Container, Preservation, and Maximum Holding Time Requirements.

2. Affix a completed sample container label to the appropriate sample container.

3. Carefully insert a precleaned scoop or trowel into the sludge or sediment and remove the sample. In the case of sludge exposed to air, remove the first 2 to 4 inches of material before collecting the sample.

4. When compositing a series of grab samples, combine the samples in a stainless-steel bowl or Teflon® tray.

5. Transfer the sample into the labeled container using a stainless-steel or plastic spoon, spatula, or similar tool.

6. If required, preserve the sample in accordance with SOP No. 016, Sample Container, Preservation, and Maximum Holding Time Requirements.

7. Ensure that a Teflon® liner is present in the sample container cap, if required. Secure the cap tightly on the sample container.

8. Complete all chain-of-custody documents, field logbook entries, and sample packaging requirements.

9. Decontaminate all nondisposable sampling equipment after each use and between sampling locations using the procedures in SOP No. 002, General Equipment Decontamination.

2.2 SAMPLING WITH A HAND CORER

The hand corer (see Figure 1) is used in the same situations and for the same materials as those described for the use of a scoop or trowel (see Section 2.1). However, the hand corer may be used to collect an undisturbed sample that can profile any stratification resulting from changes in material deposition.

Some hand corers can be fitted with extension handles that allow collection of samples underlying a shallow layer of liquid. Most hand corers can be adapted to hold liners, which are generally available in brass, polycarbonate plastic, or Teflon®. A liner material should be chosen that will not compromise the intended analytical procedures.

The following procedure can be used for sampling sludge or sediment with a hand corer:

1. Place all sampling equipment on plastic sheeting next to the sampling location. Sample containers should be selected in accordance with the requirements in SOP No. 016, Sample Container, Preservation, and Maximum Holding Time Requirements.

2. Affix a completed sample container label to the appropriate sample container.

3. Position a precleaned hand corer above the sampling location. Carefully deploy the hand corer into the sludge or sediment using a smooth, continuous motion.

4. When the hand corer is at the desired depth, rotate the "T" handle and retrieve the hand corer using a single, smooth motion.

5. Remove the nosepiece and extract the sample. Place the sample on a clean stainless-steel or Teflon® tray.

6. Transfer the sample into the labeled container using a stainless-steel or plastic spoon, spatula, or similar tool.

7. If required, preserve the sample in accordance with SOP No. 016, Sample Container, Preservation, and Maximum Holding Time Requirements.

8. Ensure that a Teflon® liner is present in the sample container cap, if required. Secure the cap tightly on the sample container.

9. Complete all chain-of-custody documents, field logbook entries, and sample packaging requirements.

10. Decontaminate all nondisposable sampling equipment after each use and between sampling locations using the procedures in SOP No. 002, General Equipment Decontamination.

2.3 SAMPLING WITH A GRAVITY CORER

A gravity corer (see Figure 2) can collect essentially undisturbed samples to profile strata that develop in sediment and sludge during the deposition process. Depending on the sediment or sludge density and the gravity corer's weight, the sampler typically can penetrate the sediment or sludge to a depth of 30 inches.

Gravity corers should be used carefully in open drums, shallow tanks, or lagoons with liners. A gravity corer could penetrate beyond the sludge or sediment layer and damage the liner material.

The following procedure can be used for sampling sludge or sediment with a gravity corer:

1. Place all sampling equipment on plastic sheeting next to the sampling location. Sample containers should be selected in accordance with the requirements in SOP No. 016, Sample Container, Preservation, and Maximum Holding Time Requirements.

2. Affix a completed sample container label to the appropriate sample container.

3. Attach the required length of sample line to a precleaned gravity corer. Braided, 3/16-inch nylon line is sufficient; however, 3/4-inch nylon line is easier to grasp during hoisting.

4. Secure the free end of the line to a fixed support to prevent accidental loss of the gravity corer.

5. Position the gravity corer above the sampling location. Allow the gravity corer to fall freely through the liquid and penetrate the sludge or sediment layer.

6. Retrieve the gravity corer with a smooth, continuous lifting motion. Do not bump the corer, as this may result in some sample loss.

7. Remove the nosepiece from the gravity corer. Slide the sample out of the corer into a stainless-steel or Teflon® pan.

8. Transfer the sample into the labeled container using a stainless-steel or plastic spoon, spatula, or similar tool.

9. If required, preserve the sample in accordance with SOP No. 016, Sample Container, Preservation, and Maximum Holding Time Requirements.

10. Ensure that a Teflon® liner is present in the sample container cap, if required. Secure the cap tightly on the sample container.

11. Complete all chain-of-custody documents, field logbook entries, and sample packaging requirements.

12. Decontaminate all nondisposable sampling equipment after each use and between sampling locations using the procedures in SOP No. 002, General Equipment Decontamination.

2.4 SAMPLING WITH A PONAR GRAB SAMPLER

A Ponar grab sampler (see Figure 3) can be used to sample most types of sludges and sediments. Its penetration depth usually does not exceed several inches. The Ponar grab sampler, like other grab samplers, cannot collect undisturbed samples; therefore, this sampler should be used only after all overlying water samples have been collected.

The following procedure can be used for sampling sludge or sediment with a Ponar grab sampler:

1. Place all sampling equipment on plastic sheeting next to the sampling location. Sample containers should be selected in accordance with the requirements in SOP No. 016, Sample Container, Preservation, and Maximum Holding Time Requirements.

2. Affix a completed sample container label to the appropriate sample container.

3. Attach the required length of sample line to a precleaned Ponar grab sampler. Braided, 3/4-inch nylon line is recommended for ease in hoisting.

4. Measure the distance from the water surface or other reference point to the top of the sludge or sediment. Mark this measurement on the sample line. To avoid unnecessary disturbance of the sludge or sediment from lowering the Ponar grab sampler too quickly, it is recommended that a second mark be made on the sample line to indicate the proximity of the reference mark.

5. Open the Ponar sampler's jaws until they are latched. The jaws will be triggered if the Ponar sampler comes in contact with or is supported by anything other than the sample line. Tie the free end of the sample line to a fixed support.

6. Position the Ponar grab sampler above the sampling location. Lower the sampler until the proximity mark is reached. Then, slowly lower the Ponar grab sampler until it touches and penetrates the sludge or sediment.

7. Allow the sample line to slacken a few inches to release the latching mechanism that closes the sampler's jaws. As the jaws close, they scoop the sludge or sediment up into the sampler. More slack may be required when sampling in surface waters with strong currents.

8. Retrieve the sampler and release its contents into a stainless-steel or Teflon® tray.

9. Transfer the sample into the labeled container using a stainless-steel or plastic spoon, spatula, or similar tool.

10. If required, preserve the sample in accordance with SOP No. 016, Sample Container, Preservation, and Maximum Holding Time Requirements.

11. Ensure that a Teflon® liner is present in the sample container cap, if required. Secure the cap tightly on the sample container.

12. Complete all chain-of-custody documents, field logbook entries, and sample packaging requirements.

13. Decontaminate all nondisposable sampling equipment after each use and between sampling locations using the procedures in SOP No. 002, General Equipment Decontamination.

FIGURE 1

HAND CORER

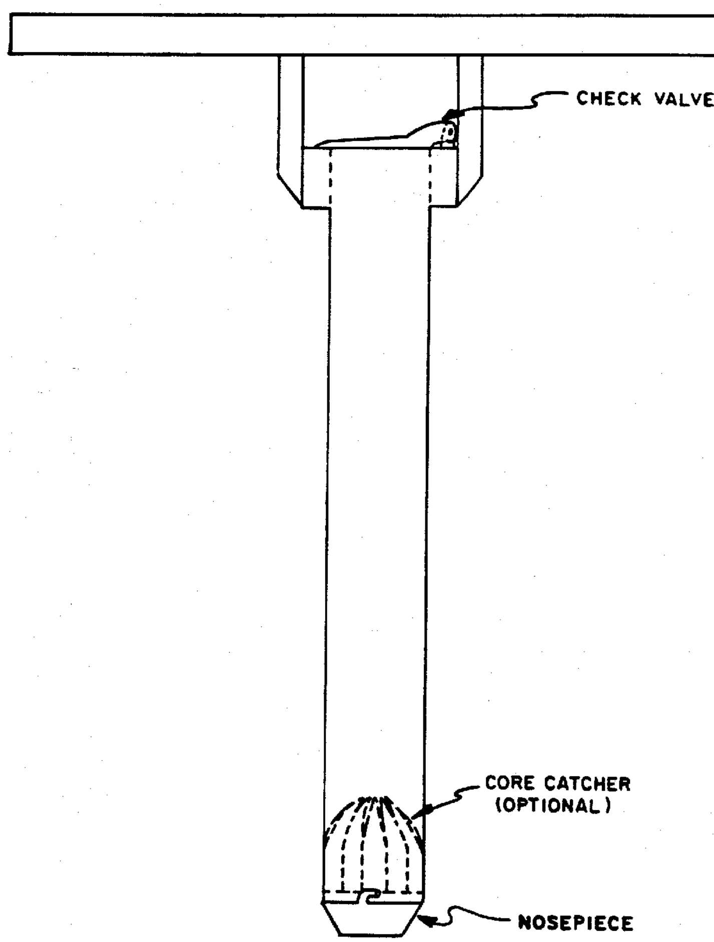


FIGURE 2

GRAVITY CORER

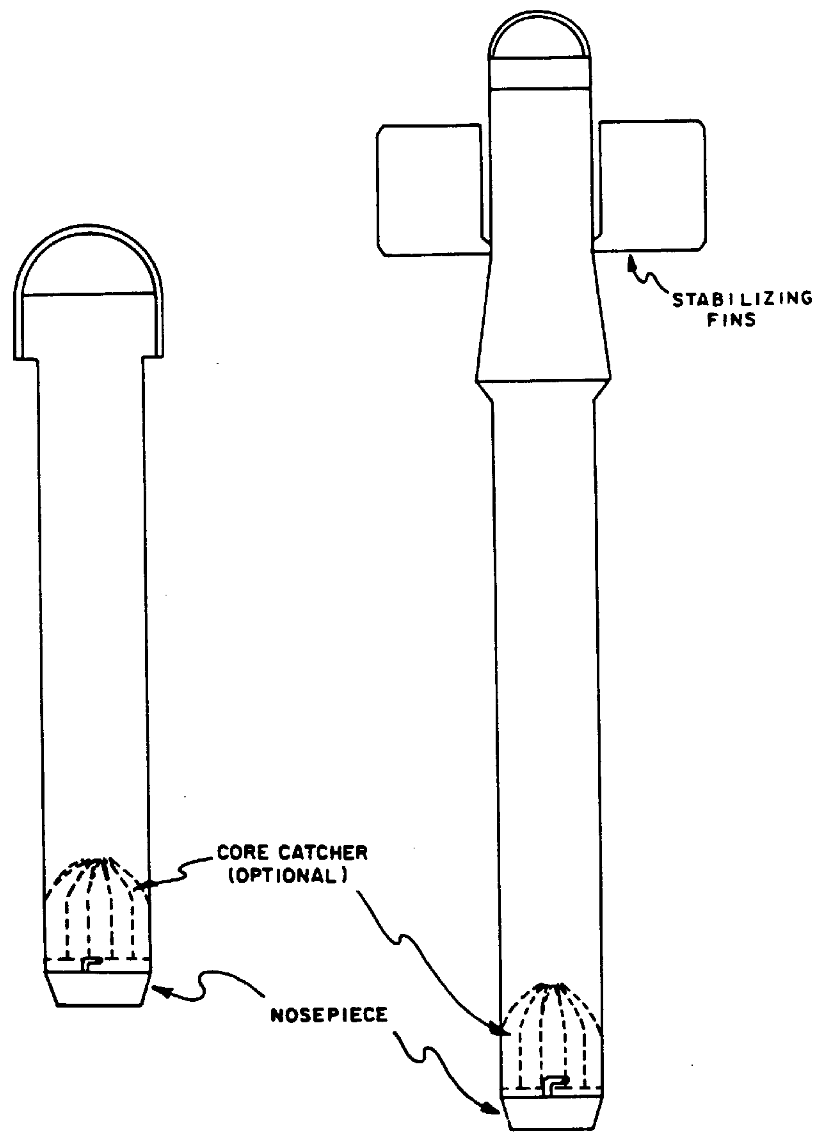
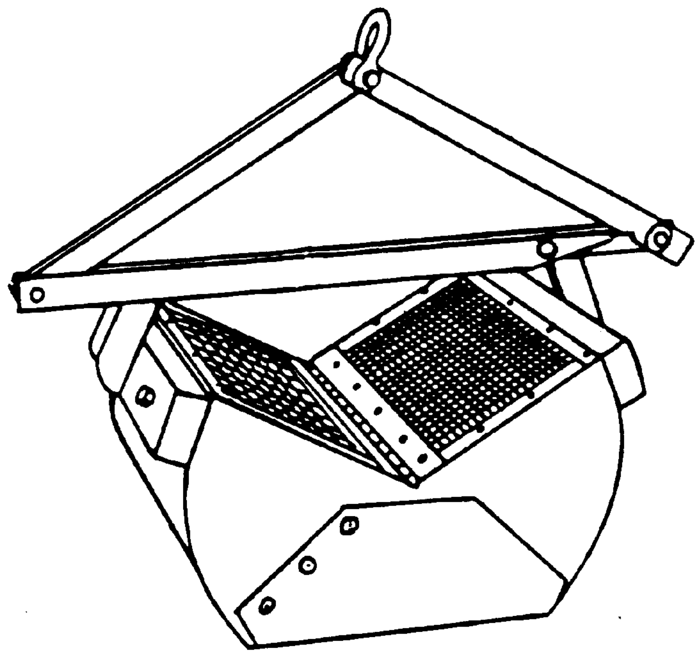


FIGURE 3

PONAR GRAB SAMPLER



SOP APPROVAL FORM

TETRA TECH EM INC.

ENVIRONMENTAL STANDARD OPERATING PROCEDURE

CONTAINERIZED LIQUID, SLUDGE, AND SLURRY SAMPLING

SOP NO. 008

REVISION NO. 2

Last Reviewed: January 2000

	May 18, 1993
Quality Assurance Approved	Date

1.0 BACKGROUND

Taking samples of liquid, sludge, and slurry from drums or other containers can present some unique problems. Manmade containers are typically closed. Containers are usually accessed either through small ports, manways, hatches, taps, or bungs. The size, shape, construction material, and location of a container may limit the types of equipment and methods that can be used to collect samples.

1.1 PURPOSE

This standard operating procedure (SOP) establishes procedures for sampling liquid, sludge, and slurry from containers.

1.2 SCOPE

Opening a closed container is a potentially hazardous task because toxic vapors and gases potentially could be released causing explosive reactions. Whenever containers that may contain hazardous materials are to be opened for sampling or any other reason, the sampling team should follow appropriate guidelines provided in site-specific sampling plans, health and safety plans, and the general guidelines in this SOP.

How containers are opened will depend on the purpose of the sampling; site conditions; the number, type, and condition of the containers; and the anticipated type of media to be sampled. As a result, no comprehensive procedures can be defined for sampling all types of containerized liquid, sludge, and slurry. This SOP provides general guidelines for dealing with problems that may be encountered while opening containers and sampling the media. General procedures are provided for sampling containerized liquid, sludge, and slurry using glass tubes and composite liquid waste samplers (COLIWASA).

1.3 DEFINITIONS

Bung Remover: A device used to open the lid of a drum.

COLIWASA: Composite liquid waste sampler used to sample free-flowing liquids and slurries in containers.

Hazardous Samples: Hazardous samples include dangerous goods and hazardous substances. Hazardous samples shipped by air should be packaged and labeled in accordance with procedures specified by the International Air Transportation Association (IATA) Dangerous Goods Regulations (DGR); ground shipments should be packaged and labeled in accordance with the U.S. Department of Transportation (DOT) Hazardous Materials Regulations (HMR, *Code of Federal Regulations*, Title 49 [49 CFR] Parts 106 through 180). See SOP No. 019 (Packaging and Shipping Samples) for additional information.

Photoionization Detector (PID): A direct-reading air monitoring instrument used to measure organic vapors based on the principle of photoionization. Examples of PIDs include the HNu and the Microtip.

Flame Ionization Detector (FID): A direct-reading, air monitoring instrument used to measure organic vapors based on the principle of flame ionization. An example of an FID is an organic vapor analyzer (OVA).

1.4 REFERENCES

American Society for Testing and Materials (ASTM) 1997. "Standard Practice for Sampling With a Composite Liquid Waste Sampler (COLIWASA)." ASTM D 5495-94.

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U.S. Environmental Protection Agency (EPA). 1994. "Drum Sampling." Environmental Response Team SOP #2009 (Rev. #0.0, 11/16/94). On-Line Address: http://204.46.140.12/media_resrcs/media_resrcs.asp?Child1=

1.5 REQUIREMENTS AND RESOURCES

Depending on container specifications and the method selected for collecting samples, the following equipment may be required to sample liquid, sludge, and slurry from containers:

- Glass tubes
- FID or PID
- Bung remover
- COLIWASA
- Rubber stopper
- Stainless-steel spatula
- Chain-of-custody forms and shipping materials
- Sample containers and labels
- Appropriate personal protective equipment (PPE)
- A permanent marker for labeling containers

2.0 PROCEDURES

Opening a closed container may potentially release toxic vapors and gases that could cause an explosive reaction. The decision to open a container to sample the contents should be made only after other potentially less dangerous site characterization methods, such as geophysical investigations or sampling of noncontainerized media, have been ruled out. In some cases, however, sampling the contents of the container may be necessary for use in legal cases or for other reasons.

Until the container contents are characterized, the sampling team should assume that materials in unlabeled containers are hazardous. Labeled containers such as 55-gallon drums are often reused and can be mislabeled. The sampling team should exercise caution when working with or around containers.

When the decision to open a container has been made, the sampling team must assess potential exposure risks. Risk factors include the number, type, and condition of containers; site conditions that could prevent a container from being safely and efficiently opened; and the anticipated contents of the container. Based on this information and based on the scope of work for the project, the sampling team should consist of at least two persons and develop a safe procedure for opening the container and sampling its contents.

Sampling team members must wear appropriate PPE when opening and sampling containers. In some cases, particularly when the contents of the container are not positively known the sampling team should consider using a remote drum opener to open closed containers. The choice of remote drum opening methods depends on the number of drums to be opened, their contents, and their physical condition. One type of remote drum opener uses hydraulic pressure to push a non-sparking metal spike into either the side or top of the drum.

After the container is opened, headspace gases should be monitored using an intrinsically safe monitoring instrument. At a minimum, a preliminary check using appropriate air-monitoring instruments should be conducted to help determine the level of PPE required and the appropriate sampling method.

Layering or stratification of any material left undisturbed over time is likely. Agitation of the container to homogenize the material can be difficult and is undesirable if the contents of the container are not known. The sampling team must ensure that samples represent the entire contents of the container, not just the contents of a single layer.

For sampling liquid and sludge in drums or other small to medium-sized containers, the glass tube sampling method is recommended. Tubes are available that collect a sample from the full depth of a drum and retain it until placement in a sample container. This sampling method is discussed in detail in Section 2.1. The COLIWASA is widely used to sample containerized and free-flowing liquids and slurries in drums and other containers. It also is used for sampling immiscible liquid-phase waste. Use of the COLIWASA is outlined in Section 2.2.

2.1 SAMPLING USING GLASS TUBES

Glass tubes can be used to sample liquids and sludge in containers such as 55-gallon drums. Glass tubes designed for this purpose are normally 122 centimeters (4 feet) long and have an inside diameter of 0.6 to 1.6 centimeters (0.24 to 0.63 inches). Glass tubes with larger inside diameters are used for sampling viscous liquids. When sampling is completed, the glass tubes can be broken and disposed of in the container just sampled. This eliminates the need for cleanup and disposal. However, if disposal of the tube by breaking in into the drum interferes with plans for the removal of the container contents, other disposal techniques should be evaluated.

The glass tube method is a quick, relatively inexpensive way of sampling containerized liquid and sludge. The major disadvantage of this method is that some sample loss may occur when sampling less viscous liquids. Splashing of such liquids also can expose sampling team members to potentially hazardous materials. For this reason, appropriate PPE, such as a butyl rubber apron, a face shield, safety glasses, respirators, boot covers, and gloves may be needed when using the glass tube method.

The procedures for sampling liquids and sludge using the glass tube method are given below. Following these procedures, cautionary notes are provided.

2.1.1 Sampling Containerized Liquids Using a Glass Tube

The following procedures can be used to sample containerized liquids using a glass tube:

1. Place all sampling equipment on a plastic sheet next to the container to be sampled. Sample containers should be selected in accordance with the requirements in SOP No. 016, Sample Preservation, Holding Time, and Container Requirements.

2. Affix a completed sample container label to the appropriate sample container.

3. Wear appropriate PPE. Use a PID or FID to monitor airborne organic vapors and gases in the breathing zone. In most cases, a PID is preferred because it is intrinsically safe, although an FID may be appropriate in some cases.

4. Record in the field logbook all exterior container markings, special conditions, and the type of opening through which the sample will be collected.

5. Using a permanent marker, make a unique identifying number on the container.

6. Locate an existing opening or bung hole in the container, if possible.

7. Using nonsparking tools, a bung remover, or a remote drum opener, carefully remove the cover or bung from the container.

8. Slowly insert a glass tube to a level slightly above the bottom of the container or until a solid layer is encountered. If layering or stratification of the liquids in the container is expected, the glass tube should be inserted at a rate that permits the liquid level inside and outside the tube to be about the same. Keep at least 30 centimeters (12 inches) of the glass tube above the top of the container.

9. Allow the liquid in the container to reach its natural level in the glass tube.

10. Cap the top of the glass tube with a safety-gloved thumb or a rubber stopper.

11. Remove the capped glass tube from the container, look for different layers, and insert the uncapped end into the labeled sample container.

12. Release the thumb or rubber stopper from the glass tube to allow the liquid to drain into the sample container.

13. Fill the sample container to approximately 90 percent of its capacity. Repeat steps 8 through 12 if more volume is needed to fill the sample container.

14. Dispose of the glass tube in an appropriate manner.

15. Ensure that a Teflon® liner is present in the sample container cap. Secure the cap tightly on the sample container. All containerized liquid samples should be evaluated in accordance with the "Sample Classification" section of SOP No. 019 (Packaging and Shipping Samples) to determine if they are hazardous samples; hazardous samples should be packaged and shipped in accordance with Dangerous Goods Regulations.

16. Replace the bung in the container or seal the opening in the container with plastic.

17. Complete all chain-of-custody forms and record sampling activities in the field logbook. Unless the sample will be analyzed at the site, complete all sample packaging requirements in accordance with SOP No. 019, Packaging and Shipping Samples.

2.1.2 Sampling Containerized Sludge Using a Glass Tube

The following procedures can be used to sample containerized sludge using a glass tube.

1. Follow steps 1 through 7 for sampling containerized liquids using a glass tube (see Section 2.1.1).

2. Slowly insert a glass tube to a level slightly above the top of the sludge layer. Keep at least 30 centimeters (12 inches) of the glass tube above the top of the container.

3. Allow the liquid in the container to reach its natural level in the glass tube.

4. Gently push the glass tube into the sludge layer at the bottom of the container.

5. Cap the top of the glass tube with a safety-gloved thumb or a rubber stopper.

6. Remove the capped glass tube from the container and insert the uncapped end into the labeled sample container (for example, a wide-mouthed, 8-ounce glass jar).

7. Release the thumb or rubber stopper from the glass tube to allow the material to drain into the sample container. If necessary, the sludge sample in the bottom of the tube may be dislodged using a stainless-steel spatula.

8. Fill the container to approximately 90 percent of its capacity. Repeat steps 2 through 7 if more volume is needed to fill the sample container.

9. Dispose of the glass tube in an appropriate manner.

10. Ensure that a Teflon® liner is present in the sample container cap. Secure the cap tightly on the sample container. All containerized sludge samples should be evaluated in accordance with the "Sample Classification" section of SOP No. 019 (Packaging and Shipping Samples) to determine if they are hazardous samples; hazardous samples should be packaged and shipped in accordance with Dangerous Goods Regulations.

11. Replace the bung in the container or seal the opening in the container with plastic.

12. Complete all chain-of-custody forms and record sampling activities in field logbook. Unless the sample will be analyzed at the site, complete all sample packaging requirements in accordance with SOP No. 019, Packaging and Shipping Samples.

2.1.3 Cautionary Notes

Because there is potential for problems, interferences, and accidents to occur during sampling of containerized liquids and sludges, the following cautionary notes are provided.

1. If you observe any reaction when the glass tube is inserted into the container (for example, violent agitation, smoke, light, or heat), leave the area immediately.

2. If the glass tube becomes cloudy or smoky after inserting it into the container, hydrofluoric acid may be present. Glass tube sampling is inappropriate in this circumstance. Instead, use a comparable length of rigid plastic tubing to collect the sample and transfer the sample to an appropriate sample container.

3. When solid material is encountered in a container (either a floating layer or bottom sludge), use the sludge sampling procedure to collect a sample of the material.

Alternatively, if the container opening is sufficiently large, the material may be sampled with a disposable scoop attached to a disposable wooden or plastic rod.

2.2 SAMPLING USING THE COLIWASA

The COLIWASA is used to collect samples of containerized or free-flowing liquid and slurry in drums and other containers. The COLIWASA is commercially available; however, it can be assembled from a variety of materials, including polyvinyl chloride (PVC), glass, or Teflon®. It consists of a 152-centimeter (5-foot) -long tube with an inside diameter of 4 centimeters (1.6 inches). The tube has a neoprene stopper at one end attached by a rod running the length of the tube to a locking mechanism at the other end. Manipulation of the locking mechanism opens and closes the COLIWASA by raising and lowering the neoprene stopper.

The recommended COLIWASA design is shown in Figure 1. The design may be modified to meet the needs of a sampling situation. The major drawbacks of using a COLIWASA involve decontamination and cost. The COLIWASA is difficult to decontaminate in the field and has a high cost compared to glass tubes. However, disposable COLIWASAs are available and are a viable alternative. The COLIWASA's major advantage is its ability to collect samples that accurately represent a multiphase waste.

The following procedure can be used for sampling containerized liquid or slurry using the COLIWASA:

1. If a commercial COLIWASA is unavailable, select the material to make the COLIWASA (for example, PVC, glass, or Teflon®). Assemble the sampler as shown in Figure 1. Check the COLIWASA to make sure it is functioning properly. Adjust the locking mechanism so that the neoprene stopper provides a thin closure.

2. If using a nondisposable COLIWASA, clean the COLIWASA according to procedures specified in SOP No. 002, General Equipment Decontamination. Place all sampling equipment on a plastic sheet next to the container to be sampled. Sample containers should be selected in accordance with the requirements in SOP No. 016, Sample Preservation, Holding Time, and Container Requirements.

3. Affix a completed sample container label to the appropriate sample container.

4. Wear appropriate PPE. Use a PID or FID to monitor airborne organic vapors and gases in the breathing zone. In most cases a PID is preferred because it is intrinsically safe, although an FID may be appropriate in some cases.

5. Record in the field logbook all exterior container markings, special conditions, and the type of opening through which the sample will be collected.

6. Using a permanent marker, make a unique identifying number on the container.

7. Locate an existing opening or a bung hole in the container, if possible.

8. Using nonsparking tools, a bung remover, or a remote drum opener, carefully remove the cover or bung from the container.

9. Place the COLIWASA in the open (sampling) position. The stopper rod handle should be in the T position, and the rod should be pushed down until the handle rests against the locking block.

10. Slowly lower the COLIWASA into the liquid or slurry at a rate that permits the levels of the liquid or slurry inside and outside the COLIWASA tube to be about the same. If the liquid or slurry level in the COLIWASA tube is lower than that outside the COLIWASA tube, the sampling rate is too fast and will produce a nonrepresentative sample.

11. When the stopper reaches the bottom of the container, push the COLIWASA tube downward against the stopper to close it. Lock the COLIWASA tube in the closed position by turning the stopper rod handle from the T position until it is upright and one end rests tightly against the locking block.

12. Remove the COLIWASA tube from the container and wipe it with a disposable cloth.

13. Slowly discharge the sample into the labeled sample container. To do this, slowly pull the lower end of the stopper rod handle away from the locking block while the lower end of the COLIWASA tube is positioned in the sample container.

14. Ensure that a Teflon® liner is present in the sample container cap. Secure the cap tightly on the sample container. All containerized liquid and slurry samples should be evaluated in accordance with the "Sample Classification" section of SOP No. 019 (Packaging and Shipping Samples) to determine if they are hazardous samples; hazardous samples should be packaged and shipped in accordance with Dangerous Goods Regulations.

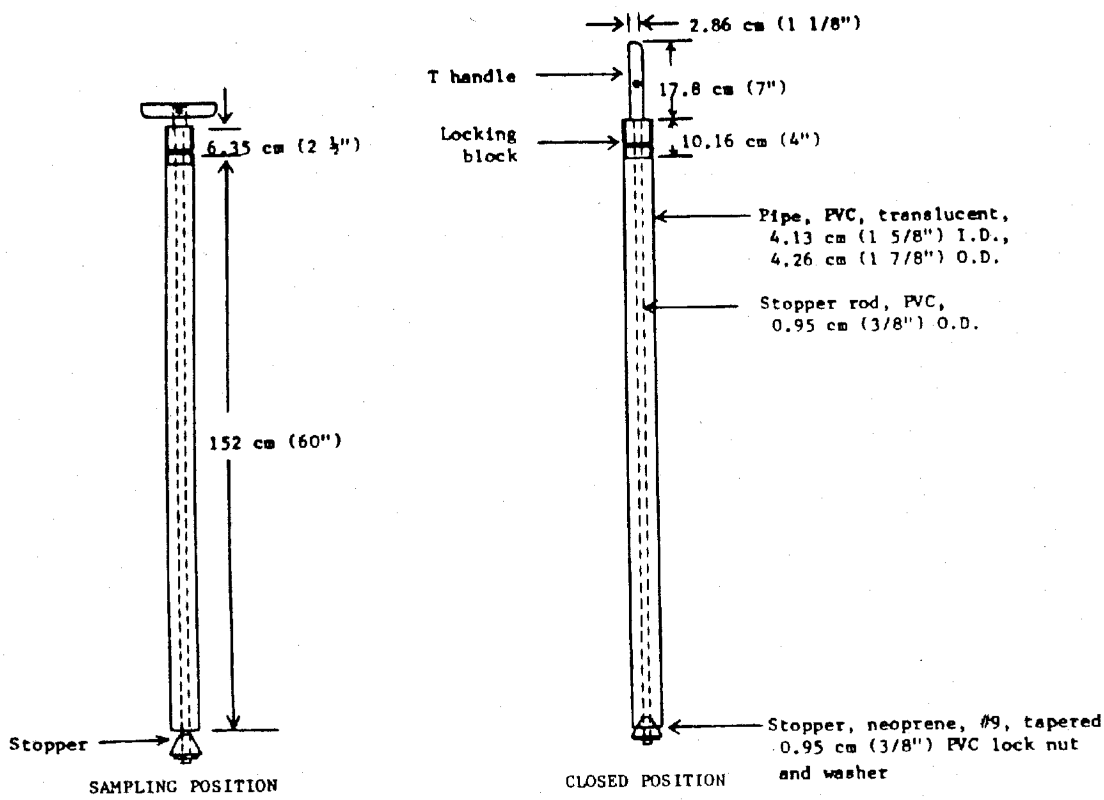
15. Replace the bung in the container or seal the opening in the container with plastic.

16. Complete all chain-of-custody forms and record sampling activities in the field logbook. Unless the sample is to be analyzed at the site, complete all sample packaging requirements in accordance with SOP No. 019, Packaging and Shipping Samples.

17. If a disposable COLIWASA was used, dispose of the device in an appropriate manner. Otherwise, unscrew the stopper rod handle of the COLIWASA tube and disengage the locking block. Decontaminate the COLIWASA tube on site or store the contaminated parts in a plastic storage tube for subsequent decontamination using the procedures in SOP No. 002, General Equipment Decontamination.

FIGURE 1

COLIWASA



SOP APPROVAL FORM

TETRA TECH EM INC.

ENVIRONMENTAL STANDARD OPERATING PROCEDURE

SURFACE WATER SAMPLING

SOP NO. 009

REVISION NO. 4

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Quality Assurance Approved

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Date

1.0 BACKGROUND

Surface water sampling is conducted to determine the quality of surface water entering, leaving, or affected by a site. Surface water bodies that can be sampled include streams, rivers, lakes, ponds, lagoons, and surface impoundments. This standard operating procedure (SOP) discusses common methods of collecting grab samples that represent water quality in a water body at a particular point in time.

A series of grab samples also can be composited to represent water quality over a longer period of time. Composite samples can be flow proportional or time proportional. The details of compositing water samples are not included in this SOP.

1.1 PURPOSE

This SOP establishes the requirements and procedures for surface water sampling.

1.2 SCOPE

This SOP applies to surface water sampling and the instruments and methods used to collect the samples.

1.3 DEFINITIONS

Kemmerer Sampler: A messenger-activated water sampling device. Water flows through the device until the release mechanism is triggered to close the container.

Peristaltic Pump: A rotary, positive-displacement pumping device characterized by its low suction and rhythmic operation, and by the fact that the pump does not come into direct contact with the water being sampled.

Pond Sampler: A sampling device fabricated by using an adjustable beaker clamp to attach a beaker to a telescoping, heavy-duty aluminum pole.

1.4 REFERENCES

U.S. Environmental Protection Agency (EPA). 1977. "Procedures Manual for Ground Water Monitoring at Solid Waste Disposal Facilities." EPA-530/SW-611. August.

EPA. 1980. "Samplers and Sampling Procedures for Hazardous Waste Streams." EPA-600/2-80-018. January.

EPA. 1984. "Characterization of Hazardous Waste Sites — A Methods Manual, Volume II. Available Sampling Methods." Second Edition. EPA-600/4-84-076. December.

EPA. 2002. "Surface Water Sampling." Environmental Response Team SOP #2013 (Rev. #1.0, 12/17/02). On-Line Address: http://loostrom.com/kosov/separatasidor/usepasurfacewatersampling.pdf

EPA. 2007. "Operating Procedure – Surface Water Sampling." Science and Ecosystem Support Division. SCSDPROC-201-R1. November.

1.5 REQUIREMENTS AND RESOURCES

Surface water sampling requires a variety of procedures and instruments. The choice of procedure should be determined by site-specific conditions, such as the type of surface water body, the sampling depth, and the sample location's distance from shore.

Samples can be collected from shallow depths by submerging the sample container. An intermediary disposable collection container or one constructed of a nonreactive material also may be used. A pond sampler, a peristaltic pump, or a Kemmerer sampler may be used to provide extended reach. The following equipment may be required to sample surface water:

- Decontamination materials
- Sample containers and labels
- Point-source bailer
- Dipper
- Boat
- Pond sampler
- Peristaltic pump with batteries or power source
- Silicone tubing
- Heavy-wall Teflon® tubing

- Kemmerer sampler
- Bucket
- Logbook or field data sheets
- Chain-of-custody documentation
- Shipping materials

2.0 PROCEDURES

Safe access, handling, and other physical limitations should be influential factors during surface water sampling. A site-specific sampling plan should delineate which of the procedures described below will be used. Any deviations from the sampling plan should be recorded in the site-specific field logbook.

The following subsections provide detailed procedures for surface water sampling using specific instruments and methods. In all cases, select a sampling location where the water quality will best represent the water chemistry of the water body. Avoid stagnant or fast-moving areas. Do not sample immediately downstream of incoming tributaries, because of the likelihood of incomplete mixing.

2.1 SURFACE WATER SAMPLING BY SUBMERGING SAMPLE CONTAINER

Samples from shallow depths should be collected by submerging the sample container. This method is advantageous when the sample might be significantly altered during transfer from a collection vessel into another container. This method should not be used for sampling lagoons or surface impoundments where contact with contaminants is a potential concern.

The following procedure can be used for sampling surface water by submerging the sample container:

1. Place all equipment on plastic sheeting next to the sampling location. Sample containers should be selected in accordance with the requirements specified in the project-specific field work plan, field sampling plan, or quality assurance project plan (QAPP).
2. If required by the project, collect field parameter measurements using procedures in relevant specific Tetra Tech SOPs and project-specific field sampling plan. Record this information on the field sheet or in the logbook.
3. A visual check for visible surface material (pond scum or ice) should be performed before sampling. If present, surface water samples should be collected by directly

submerging the sample container (with lid still on) into the surface water at the specified sampling location. Avoid contacting the bottom of the water body with the sample container because this will disturb sediment that may interfere with the surface water sample. Once submerged, the lid should be removed to allow the container to fill with water below any visible material on the surface of the water. A visual check should be conducted during and after sample collection to ensure sample integrity. If no surface materials are present, sample as instructed below.

4. For stream sampling, sample the location farthest downstream first. In general, work from zones suspected of low contamination to zones of high contamination. Orient the mouth of the sample container facing upstream while standing downstream so as not to stir up any sediment that would contaminate the sample. Avoid contacting the bottom of the water body with the sample container because this will disturb sediment that may interfere with the surface water sample.

5. For a larger body of surface water, such as a lake, collect samples near the shore, unless boats are feasible and permitted. Collect samples from shallow depths by submerging the sample container. Avoid contacting the bottom of the water body with the sample container because this will disturb sediment that may interfere with the surface water sample. If sampling from a boat, collect the sample as far away as possible from the outboard engine to avoid possible fuel contamination.

6. If sediment samples are to be collected (using procedures in SOP No. 006 [Sludge and Sediment Sampling]) with surface water samples, collect surface water samples at each location before collecting sediment samples to avoid contaminating the water samples with excess suspended particles generated during sediment sampling.

7. Continue delivery of the sample until the container is almost full. If sampling for volatile organic compounds (VOC) or other analytical parameters requiring pre-preserved sample containers, the use of a transfer device is recommended so that the preservative is not displaced.

8. Preserve the sample in accordance with requirements specified in the project-specific field work plan, field sampling plan, or QAPP. Ensure that a Teflon® liner is present in the cap of the sample container if required. Secure the cap tightly and affix a completed sample label to the container.

9. Complete all chain-of-custody documentation, field logbook entries, and sample packaging requirements.

2.2 SURFACE WATER SAMPLING WITH TRANSFER DEVICE

A dipper, bailer, or other device made of inert material, such as stainless steel or Teflon®, can be used to transfer liquid samples from their source to a sample container. This prevents contamination of the outside of the sample container as a result of direct immersion in surface water. Depending on the sampling application, the transfer device may be either disposed of or reused. If reused, the device should be thoroughly rinsed and decontaminated in accordance with SOP 002 (General Equipment Decontamination), prior to sampling a different source.

A transfer device can be used in most sampling situations, and is preferred when (1) direct contact or physical access limitations pose a health and safety concern and (2) sample containers are pre-preserved. However, direct collection by submerging the sample container is the preferred method when possible.

The following procedure can be used for sampling surface water with a dipper, bailer, or other transfer device:

1 Place all equipment on plastic sheeting next to the sampling location. Sample containers should be selected in accordance with the requirements specified in the project-specific field work plan, field sampling plan, or QAPP.

2. If required by the project, collect field parameter measurements using procedures in relevant specific Tetra Tech SOPs. Record this information on the field sheet or in the logbook.

3. With minimal surface water disturbance, submerge a precleaned dipper, bailer, or other transfer device.

4. Allow the device to fill slowly and continuously.

5. Retrieve the device from the surface water with minimal disturbance.

6. Remove the cap from the sample container. Slightly tilt the mouth of the container below the edge of the transfer device.

7. Empty the device slowly, allowing the sample to flow gently down the inside of the container with minimal entry turbulence. Continue delivery of the sample until the container is almost full. If sampling for VOCs, the container must be completely filled leaving no head space.

8. Preserve the sample in accordance with requirements specified in the project-specific field work plan, field sampling plan, or QAPP. Ensure that a Teflon® liner is present in

the cap of the sample container if required. Secure the cap tightly and affix a completed sample label to the container.

9. Complete all chain-of-custody documentation, field logbook entries, and sample packaging requirements.

10. Decontaminate the transfer device prior to reuse or storage using the procedures in SOP No. 002 (General Equipment Decontamination).

2.3 SURFACE WATER SAMPLING WITH POND SAMPLER

A pond sampler may be used to collect liquid samples from ponds, pits, and lagoons (see Figure 1). A pond sampler is easily and inexpensively fabricated. To construct a pond sampler, use an adjustable clamp to attach a sampling beaker to the end of a two- or three-piece telescoping aluminum tube. The telescoping tube serves as the handle. All nondisposable equipment should be cleaned before and after each use.

The following procedure can be used for sampling surface water with a pond sampler:

1. Place all equipment on plastic sheeting next to the sampling location. Sample containers should be selected in accordance with the requirements specified in the project-specific field work plan, field sampling plan, or QAPP.

2. If required by the project, collect field parameter measurements using procedures in relevant specific Tetra Tech SOPs. Record this information on the field sheet or in the logbook.

3. Assemble the pond sampler. Ensure that the sampling beaker, bolts, and nuts securing the clamp to the pole are tightened properly.

4. Collect the sample by slowly submerging the precleaned beaker with minimal surface water disturbance.

5. Retrieve the pond sampler from the surface water with minimal disturbance.

6. Remove the cap from the sample container. Slightly tilt the mouth of the container below the edge of the beaker.

7. Empty the beaker slowly, allowing the sample to flow gently down the inside of the container with minimal entry turbulence. Continue delivery until the container is almost full. If sampling for VOCs, the container must be completely filled leaving no head space.

8. Preserve the sample in accordance with requirements specified in the project-specific field work plan, field sampling plan, or QAPP. Ensure that a Teflon® liner is present in the cap of the sample container if required. Secure the cap tightly and affix a completed sample label to the container.

9. Complete all chain-of-custody documentation, field logbook entries, and sample packaging requirements.

10. Decontaminate the pond sampler prior to reuse or storage using the procedures in SOP No. 002 (General Equipment Decontamination).

2.4 SURFACE WATER SAMPLING WITH PERISTALTIC PUMP

To extend reach in sampling efforts, a small peristaltic pump can be used (see Figure 2). A peristaltic pump draws the sample through heavy-wall Teflon® tubing and pumps it directly into the sample container. Use of a peristaltic pump allows the operator to reach out into a liquid body, to sample from a depth or to sweep the width of a narrow stream. A battery-powered pump is preferable because it eliminates the need for a direct current generator or an alternating current inverter.

If medical-grade silicone tubing is used in the peristaltic pump, it is suitable for sampling almost any parameter, including most organics. However, some VOC stripping may occur and some sample material may adhere to the tubing. Teflon® tubing may be used in place of silicone tubing on the intake side of the pump to minimize the amount of sample adherence to the tubing. If tubing is to be reused, it should be cleaned before and after each use following the procedures specified in SOP No. 002 (General Equipment Decontamination). Depending on project requirements, it may be necessary to replace the Teflon® intake tubing and the pump silicone tubing between sampling locations to prevent cross contamination.

Procedures for sampling surface water with a peristaltic pump are as follows:

1. Place all equipment on plastic sheeting next to the sampling location. Sample containers should be selected in accordance with the requirements specified in the project-specific field work plan, field sampling plan, or QAPP.

2. If required by the project, collect field parameter measurements using procedures in relevant specific Tetra Tech SOPs. Record this information on the field sheet or in the logbook.

3. Install clean, medical-grade silicone tubing in the pump head according to the manufacturer's instructions. Allow enough tubing on the discharge side to facilitate

delivery of liquid into the sample container. Allow only enough tubing on the suction end for attachment to the intake line. This will minimize sample contact with the tubing.

4. Select the length of intake tubing needed to reach the required sample location. Attach it to the intake side of the pump tubing. Heavy-wall Teflon® tubing of a diameter equal to that of the required pump tubing suits most applications. A heavier tubing wall will allow slightly greater lateral reach.

5. If possible, allow several liters of surface water to pass through the pump before collecting the sample. Collect this purge volume. Return it to the source after the samples have been withdrawn.

6. Fill the sample container by allowing the pump discharge to flow gently down the inside of the bottle with minimal entry turbulence. Continue delivery of the sample until the container is almost full.

7. If sampling for VOCs, the VOC sample must be collected using one of the "soda straw" variations. Ideally, the tubing intake will be placed at the depth from which the sample is to be collected and the pump will be run for several minutes to fill the tubing with water representative of that interval. After several minutes, the pump is turned off and the tubing string is retrieved. The pump speed is then reduced to a slow pumping rate and the pump direction is reversed. After the pump is turned back on, the sample stream is collected into the VOC vials as it is pushed from the tubing by the pump. Care must be taken to prevent any water that was in contact with the peristaltic pump head tubing from being incorporated into the sample.

8. Preserve the sample in accordance with requirements specified in the project-specific field work plan, field sampling plan, or QAPP. Ensure that a Teflon® liner is present in the cap of the sample container if required. Secure the cap tightly and affix a completed sample label to the container.

9. Complete all chain-of-custody documentation, field logbook entries, and sample packaging requirements.

10. Allow the pump to drain, and then disassemble it. Decontaminate the tubing before reuse using the procedures in SOP No. 002 (General Equipment Decontamination), or dispose of it.

2.5 SURFACE WATER SAMPLING WITH KEMMERER SAMPLER

The Kemmerer sampler (see Figure 3) is used to collect surface water samples when the required sample depth is greater than that which can be sampled with a pump. A Kemmerer sampler may be constructed of various materials to be compatible with the required analytical technique. The sampler should be cleaned before and after each use.

Procedures for sampling surface water with a Kemmerer sampler are as follows:

1. Place all equipment on plastic sheeting next to the sampling location. Sample containers should be selected in accordance with the requirements in specified in the project-specific field work plan, field sampling plan, or QAPP.

2. If required by the project, collect field parameter measurements using procedures in relevant specific Tetra Tech SOPs. Record this information on the field sheet or in the logbook.

3. Inspect the body of the Kemmerer sampler to ensure that the drain line valve is closed, as appropriate. Measure and mark the sample line (cable) at the desired sampling depth.

4. Open the sampler by lifting the upper stopper-trip head assembly.

5. Gradually lower the sampler into the surface water until the sample liquid reaches the sample line.

6. Place a messenger on the sample line and release it, closing the sampler.

7. Retrieve the sampler. Prevent accidental opening of the lower stopper by holding the center rod of the sampler.

8. Rinse or wipe off the exterior of the sampler. Recover the sample by grasping the lower stopper and sampler body with one hand. Transfer the sample by lifting the upper stopper with the other hand and carefully pouring the contents into the sample container. If a drain line valve is present, hold the valve over the sample container, and open the valve slowly to release the sample.

9. Transfer the sample slowly, allowing it to flow gently down the inside of the container with minimal entry turbulence. Continue delivery until the container is almost full. If sampling for VOCs, the container must be completely filled leaving no head space.

10. Preserve the sample in accordance with requirements specified in the project-specific field work plan, field sampling plan, or QAPP. Ensure that a Teflon® liner is present in the cap of the sample container if required. Secure the cap tightly and affix a completed sample label to the container.

11. Complete all chain-of-custody documentation, field logbook entries, and sample packaging requirements.

12. Decontaminate the Kemmerer sampler prior to reuse or storage using the procedures in SOP No. 002 (General Equipment Decontamination).

2.6 SURFACE WATER SAMPLING WITH BUCKET

A plastic bucket is used to collect surface water samples for measurement of water quality parameters (such as pH, temperature, and conductivity) or classical water quality parameters (ammonia, nitrate-nitrite, phosphorus, and total organic carbon). This method is not recommended for collecting samples for chemical analysis. A bucket is commonly used to collect a sample when the water depth is too great for wading, it is not possible to deploy a boat, or access is restricted (excessive vegetation or steep embankments) and the water column is well mixed. The water body is usually accessed from a bridge. The bucket is lowered by rope over the side of the bridge and, upon retrieval, the water is poured into the appropriate sample containers.

FIGURE 1

POND SAMPLER

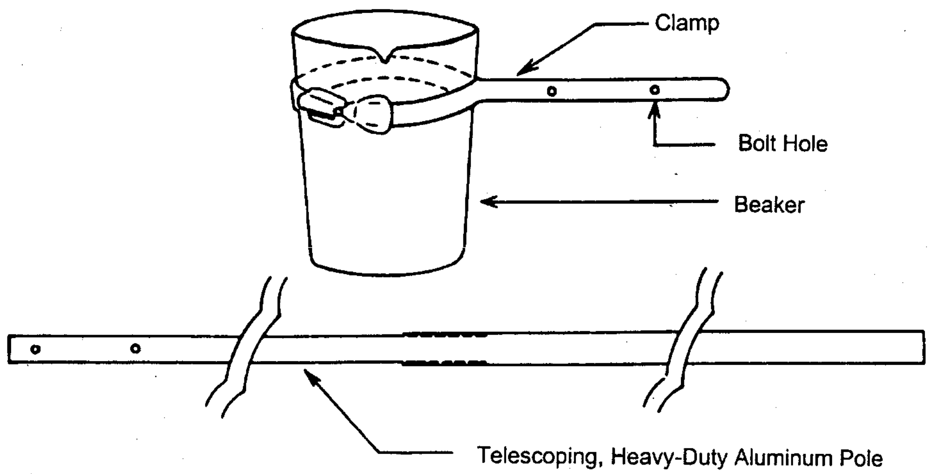


FIGURE 2

PERISTALTIC PUMP FOR LIQUID SAMPLING

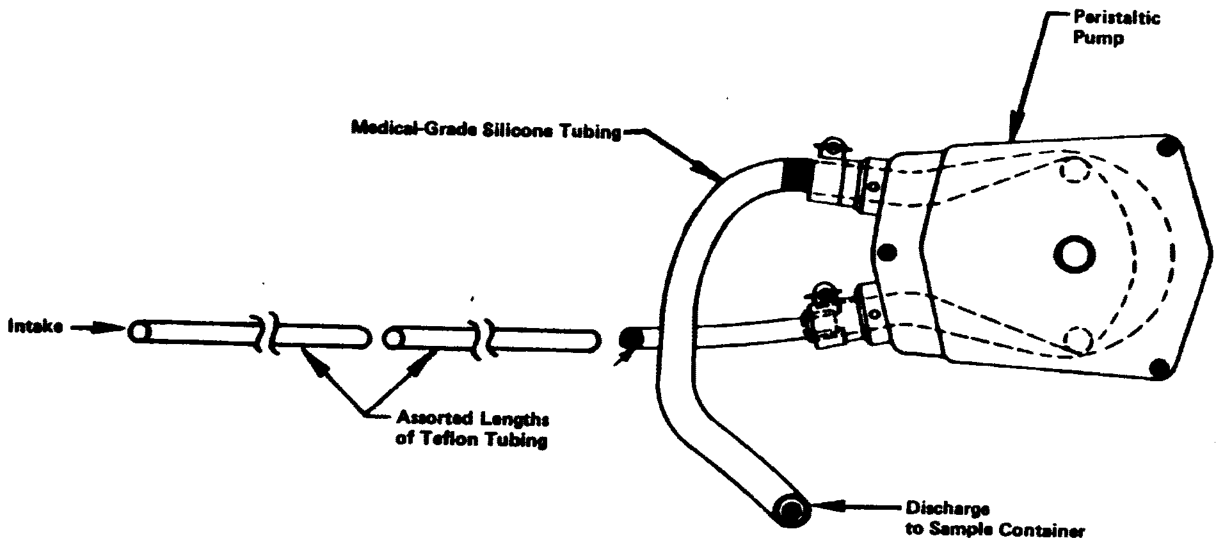
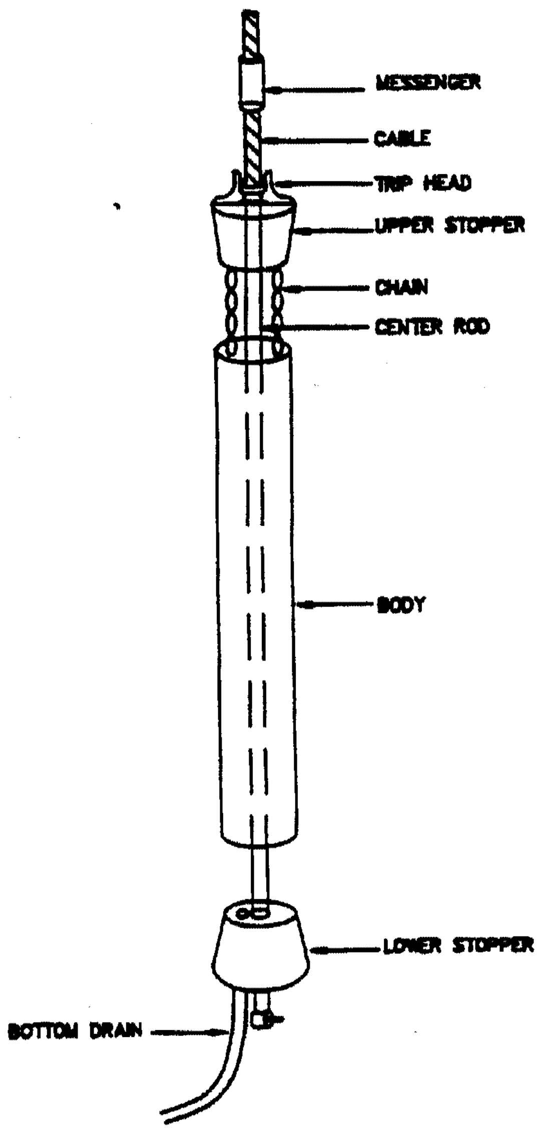


FIGURE 3

KEMMERER SAMPLER



SOP APPROVAL FORM

TETRA TECH EM INC.

ENVIRONMENTAL STANDARD OPERATING PROCEDURE

PACKAGING AND SHIPPING SAMPLES

SOP NO. 019

REVISION NO. 6

December 2008

Quality Assurance Approved	December 18, 2008 Date

1.0 BACKGROUND

In any sampling program, the integrity of a sample must be ensured from its point of collection to its final disposition. Procedures for classifying, packaging, and shipping samples are described below. Steps in the procedures should be followed to ensure sample integrity and to protect the welfare of persons involved in shipping and receiving samples. When hazardous substances and dangerous goods are sent by common carrier, their packaging, labeling, and shipping are regulated by four primary agencies that have regulatory or advisory guidelines: (1) the U.S. Department of Transportation (DOT) Hazardous Materials Regulations (HMR, *Code of Federal Regulations*, Title 49 [49 CFR] Parts 106 through 180); (2) the International Air Transportation Association (IATA) Dangerous Goods Regulations (DGR); (3) International Civil Aviation Organization (ICAO), which provides technical instructions for safe transportation of hazardous materials (dangerous goods) by air; and (4) United Nations (UN) "Recommendations of the Committee of Experts on Transport of Dangerous Goods."

1.1 PURPOSE

This standard operating procedure (SOP) establishes the requirements and procedures for packaging and shipping samples. It has been prepared in accordance with the U.S. Environmental Protection Agency (EPA) "Sampler's Guide to the Contract Laboratory Program (CLP)," the DGR, the HMR, ICAO, and UN. Sample packaging and shipping procedures described in this SOP should be followed for all sample packaging and shipping. Deviations from the procedures in this SOP must be documented in a field logbook. This SOP assumes that samples are already collected in the appropriate sample jars and that the sample jars are labeled and tagged appropriately.

1.2 SCOPE

This SOP applies to sample classification, packaging, and shipping.

1.3 DEFINITIONS

Custody seal: A custody seal is a tape-like seal. Placement of the custody seal is part of the chain-of-custody process and is used to prevent tampering with samples after they have been packaged for shipping.

Dangerous goods: Dangerous goods are articles or substances that can pose a significant risk to health, safety, or property when transported by air; they are classified as defined in Section 3 of the DGR (IATA 2008).

Environmental samples: Environmental samples include drinking water, most groundwater and ambient surface water, soil, sediment, treated municipal and industrial wastewater effluent, and biological specimens. Environmental samples typically contain low concentrations of contaminants and when handled require only limited precautionary procedures.

Hazardous Materials Regulations: The HMR are DOT regulations for the shipment of hazardous materials by air, water, and land; they are located in 49 CFR 106 through 180.

Hazardous samples: Hazardous samples include dangerous goods and hazardous substances. Hazardous samples shipped by air should be packaged and labeled in accordance with procedures specified by the DGR; ground shipments should be packaged and labeled in accordance with the HMR.

Hazardous substance: A hazardous substance is any material, including its mixtures and solutions, that is listed in Appendix A of 49 CFR 172.101 <u>and</u> its quantity, in one package, equals or exceeds the reportable quantity (RQ) listed in the appendix.

IATA Dangerous Goods Regulations: The DGR are regulations that govern the international transport of dangerous goods by air. The DGR are based on the International Civil Aviation Organization (ICAO) Technical Instructions. The DGR contain all of the requirements of the ICAO Technical Instructions and are more restrictive in some instances.

Nonhazardous samples: Nonhazardous samples are those samples that do not meet the definition of a hazardous sample and **do not** need to be packaged and shipped in accordance with the DGR or HMR.

Overpack: An enclosure used by a single shipper to contain one or more packages and to form one handling unit (IATA 2008). For example, a cardboard box may be used to contain three fiberboard boxes to make handling easier and to save on shipping costs.

1.4 REFERENCES

U.S. Department of Transportation (DOT). 2007. Code of Federal Regulations, Title 49, Parts 171 through 180, especially Parts 171 (general), 172 (table, emergency response, and so on), and 173 (for shippers). Available from http://www.access.gpo.gov/nara/cfr/cfr-table-search.html#page1. Updated annually, late in the year or early in the following year.

DOT. 2008. "Hazardous Materials Table". (49 CFR 172.101 Table) Available on-line from http://phmsa.dot.gov/hazmat/library. Updated irregularly.

DOT. 2008. "Emergency Response Guidebook". Available on-line at http://phmsa.dot.gov/hazmat/library/erg. Updated annually.

Federal Express. 2008. "Dangerous Goods Shipping". Available on-line from http://www.fedex.com/us/services/options/dangerousgoods/index.html. Note especially "Declaration Forms", which can be filled out on-line or downloaded for future use, and "Resources", which includes the "Dangerous Goods Job Aid" on how to fill out the form, mark the package, and so on, the "Shipping Checklists" and the 1-800 numbers for assistance.

International Air Transport Association (IATA). 2008. "Dangerous Goods Regulations. 2009". For sale at http://www.iata.org/ps/publications/dgr.htm. Updated annually, with new edition available late in year.

U.S. Environmental Protection Agency. 2007. "Contract Laboratory Program Guidance for Field Samplers". EPA 540-R-07-06. Available on-line at http://www.epa.gov/superfund/programs/clp/download/sampler/clp_sampler_guidance.pdf. July.

The following additional in-house resources are also available:

Email: Contact either the TtEMI Health & Safety Director and the Regional Safety Officers at EMI.HASPApprovers or your Office Health and Safety Representative (all are included at EMI.HealthSafety).

On-line: TtEMI Intranet Page "Dangerous Goods Shipping" at http://home.ttemi.com/C14/Dangerous%20Goods%20Shipping/default.aspx. Includes the "Dangerous Goods Shipping Manual", various "Emergency Response Guide" excerpts, and other information, updated regularly.

1.5 REQUIREMENTS AND RESOURCES

The procedures for packaging and shipping **nonhazardous** samples require the following:

- Coolers
- Ice
- Vermiculite, bubble wrap, or similar cushioning material
- Chain-of-custody forms and seals
- Airbills
- Resealable plastic bags for sample jars and ice
- Tape (strapping and clear)

The procedures for packaging and shipping **hazardous** samples require the following:

- Ice
- Vermiculite or other non-combustible, absorbent packing material
- Chain-of-custody forms and seals
- Appropriate dangerous goods airbills and emergency response information to attach to the airbill
- Resealable plastic bags for sample jars and ice
- Tape (strapping and clear)
- Appropriate shipping containers as specified in the DGR
- Labels that apply to the shipment such as hazard labels, address labels, “Cargo Aircraft Only” labels, and package orientation labels (up arrows)

2.0 PROCEDURES

The following procedures apply to packaging and shipping nonhazardous and hazardous samples.

2.1 SAMPLE CLASSIFICATION

Prior to sample shipment, it must be determined whether the sample is subject to the DGR. Samples subject to these regulations shall be referred to as hazardous samples. If the hazardous sample is to be shipped by air, then the DGR should be followed. Any airline, including FedEx, belonging to IATA must follow the DGR. As a result, FedEx **may not** accept a shipment that is packaged and labeled in accordance with the HMR (although in most cases, the packaging and labeling would be the same for either set of regulations). The HMR states that a hazardous material may be transported by aircraft in accordance with the ICAO Technical Instruction (49 CFR 171.11) upon which the DGR is based. Therefore, the use of the DGR for samples to be shipped by air complies with the HMR, but not vice versa.

Most environmental samples are not hazardous samples and do not need to be packaged in accordance with any regulations. Hazardous samples are those samples that can be classified as specified in Section 3 of the DGR, can be found in the List of Dangerous Goods in the DGR in bold type, are considered a hazardous substance (see definition), or are mentioned in “Section 2 - Limitations” of the DGR for countries of transport or airlines (such as FedEx). The hazard classifications specified in the DGR (and the HMR) are as follows:

Class 1 - Explosives

- Division 1.1 - Articles and substances having a mass explosion hazard
- Division 1.2 - Articles and substances having a projection hazard but not a mass explosion hazard
- Division 1.3 - Articles and substances having a fire hazard, a minor blast hazard and/or a minor projection hazard but not a mass explosion hazard
- Division 1.4 - Articles and substances presenting no significant hazard
- Division 1.5 - Very sensitive substances mass explosion hazard
- Division 1.6 - Extremely insensitive articles which do not have a mass explosion hazard

Class 2 - Gases

Division 2.1 - Flammable gas
Division 2.2 - Non-flammable, non-toxic gas
Division 2.3 - Toxic gas

Class 3 - Flammable Liquids

Class 4 - Flammable Solids; Substances Liable to Spontaneous Combustion; Substances, which, in Contact with Water, Emit Flammable Gases

Division 4.1 - Flammable solids
Division 4.2 - Substances liable to spontaneous combustion
Division 4.3 - Substances, which, in contact with water, emit flammable gases

Class 5 - Oxidizing Substances and Organic Peroxides

Division 5.1 - Oxidizers
Division 5.2 - Organic peroxides

Class 6 - Toxic and Infectious Substances

Division 6.1 - Toxic substances
Division 6.2 - Infectious substances

Class 7 - Radioactive Materials

Class 8 - Corrosives

Class 9 - Miscellaneous Dangerous Goods

The criteria for each of the first eight classes are very specific and are outlined in Section 3 of the DGR and 49 CFR 173 of the HMR. Some classes and divisions are further divided into packing groups based on their level of danger. Packing group I indicates a great danger, packing group II indicates a medium danger, and packing group III indicates a minor danger.

Class 1, explosives, includes any chemical compound, mixture, or device that by itself is capable of chemical chain reaction sufficient to produce a substantial, instantaneous release of gas, heat, and/or pressure. Tetra Tech does not ship substances that fall under this class.

Class 2, gases, includes any compressed gas being shipped and any noncompressed gas that is either flammable or toxic. A compressed gas is defined as having a pressure over 40 pounds per square inch (psi) absolute (25 psi gauge). Most air samples and empty cylinders that did not contain a flammable or toxic gas are exempt from the regulations. An empty hydrogen cylinder, as in a flame ionization detector (FID), is considered a dangerous good unless it is properly purged with nitrogen in accordance with the HMR. A landfill gas sample is usually considered a flammable gas because it may contain a high percentage of methane.

Class 3, flammable liquids, are based on the boiling point and flash point of a substance. DOT defines flammable liquids as substances with a flash point less than 140 °F. Most class 3 samples include solvents, oil, gas, or paint-related material collected from drums, tanks, or pits.

Class 4 are flammable solids; substances liable to spontaneous combustion; and substances which, in contact with water, emit flammable gasses. Tetra Tech does not ship substances that fall under this class.

Class 5, oxidizers and organic peroxides, include substances that readily yields oxygen, which may result in the ignition of combustible materials. Organic peroxide is combustible and reacts as an oxidizer in contact with other combustible materials. By itself, an organic peroxide can be flammable or explosive. Tetra Tech does not ship substances that fall under this class.

Division 6, toxic and infectious substances, is based on oral toxicity (LD_{50} [lethal dose that kills 50 percent of the test animals]), dermal toxicity (LD_{50} values), and inhalation toxicity (LC_{50} [lethal concentration that kills 50 percent of the test animals] values). Division 6.1 substances include pesticides and cyanide. Tetra Tech does not ship substances that fall under this class.

Class 7, radioactive material, is defined as any article or substance with a specific activity greater than 70 kiloBecquerels (kBq/kg) (0.002 [microCuries per gram [:Ci/g]). If the specific activity exceeds this level, the sample should be shipped in accordance with Section 10 of the DGR.

Class 8, corrosives, are based on the rate at which a substance destroys skin tissue or corrodes steel; they are not based on pH. Class 8 materials include the concentrated acids used to preserve water samples. Preserved water samples are not considered Class 8 substances and should be packaged as nonhazardous samples.

Class 9, miscellaneous dangerous goods, are substances that present a danger but are not covered by any other hazard class. Examples of Class 9 substances include asbestos, polychlorinated biphenyls (PCB), and dry ice.

Unlike the DGR, the HMR includes combustible liquids in hazard class 3. The definition of a combustible liquid is specified in 49 CFR 173.120 of the HMR. The HMR has an additional class, ORM-D, that is not specified in the DGR. "ORM-D material" refers to a material such as a consumer commodity that, although otherwise subject to the HMR, presents a limited hazard during transport due to its form, quantity, and packaging. It must be a material for which exceptions are provided in the table of 49 CFR 172.101. The DGR lists consumer commodities as a Class 9 material.

In most instances, the hazard of a material sampled is unknown because no laboratory testing has been conducted. A determination as to the suspected hazard of the sample must be made using knowledge of the site, field observations, field tests, and other available information.

According to 40 CFR 261.4(d) and (e), samples transported to a laboratory for testing or treatability studies, including samples of hazardous wastes, are **not** hazardous wastes. FedEx will not accept a shipment of hazardous waste.

2.2 PACKAGING NONHAZARDOUS SAMPLES

Nonhazardous samples, after being appropriately containerized, labeled, and tagged, should be packaged in the following manner. Note that these are general instructions; samplers should be aware of any client-specific requirements concerning the placement of custody seals or other packaging provisions.

1. Place the sample in a resealable plastic bag.
2. Place the bagged sample in a cooler and pack it to prevent breakage.
3. Prevent breakage of bottles during shipment by either wrapping the sample container in bubble wrap, or lining the cooler (bottom and sides) with a noncombustible material such as vermiculite. Vermiculite is especially recommended because it will absorb any free liquids inside the cooler. It is recommended that the cooler be lined with a large plastic garbage bag before samples, ice, and absorbent packing material are placed in the cooler.

4. Add a sufficient quantity of ice to the cooler to cool samples to 4 °C. Ice should be double bagged in resealable plastic bags to prevent the melted ice from leaking out. As an option, a temperature blank (a sample bottle filled with distilled water) can be included with the cooler.

5. Seal the completed chain-of-custody forms in a plastic bag and tape the plastic bag to the inside of the cooler lid.

6. Tape any instructions for returning the cooler to the inside of the lid.

7. Close the lid of the cooler and tape it shut by wrapping strapping tape around both ends and hinges of the cooler at least once. Tape shut any drain plugs on the cooler.

8. Place two signed custody seals on the cooler, ensuring that each one covers the cooler lid and side of the cooler. Place clear plastic tape over the custody seals.

9. Place address labels on the outside top of the cooler.

10. Ship samples overnight by a commercial carrier such as FedEx.

2.3 PACKAGING HAZARDOUS SAMPLES

The procedures for packaging hazardous samples are summarized below. Note that according to the DGR, all spellings must be exactly as they appear in the List of Dangerous Goods, and only approved abbreviations are acceptable. The corresponding HMR regulations are provided in parentheses following any DGR referrals. The HMR must be followed only if shipping hazardous samples by ground transport.

1. Determine the proper shipping name for the material to be shipped. All proper shipping names are listed in column B of the List of Dangerous Goods table in Section 4 of the DGR (or column 2 of the Hazardous Materials Table in 49 CFR 172.101). In most instances, a generic name based on the hazard class of the material is appropriate. For example, a sample of an oily liquid collected from a drum with a high photoionization detector (PID) reading should be packaged as a flammable liquid. The proper shipping name chosen for this sample would be “flammable liquid, n.o.s.” The abbreviation “n.o.s.” stands for “not otherwise specified” and is used for generic shipping names. Typically, a specific name, such as acetone, should be inserted in parentheses after most n.o.s. descriptions. However, a technical name is not required when shipping a sample for testing purposes and the components are not known. If shipping a hazardous substance (see definition), then the letters “RQ” must appear in front of the proper shipping name.

2. Determine the United Nations (UN) identification number, class or division, subsidiary risk if any, required hazard labels, packing group, and either passenger aircraft or cargo aircraft packing instructions based on the quantity of material being shipped in one

package. This information is provided in the List of Dangerous Goods (or Hazardous Materials Table in 49 CFR 172.101) under the appropriate proper shipping name. A "Y" in front of a packing instruction indicates a limited quantity packing instruction. If shipping dry ice or a limited quantity of a material, then UN specification shipping containers do not need to be used.

3. Determine the proper packaging required for shipping the samples. Except for limited quantity shipments and dry ice, these are UN specification packages that have been tested to meet the packing group of the material being shipped. Specific testing requirements of the packages is listed in Section 6 of the DGR (or 49 CFR 178 of the HMR). All UN packages are stamped with the appropriate UN specification marking. Prior planning is required to have the appropriate packages on hand during a sampling event where hazardous samples are anticipated. Most samples can be shipped in either a 4G fiberboard box, a 1A2 steel drum, or a 1H2 plastic drum. Drums can be purchased in 5- and 20-gallon sizes and are ideal for shipping multiple hazardous samples. When FedEx is used to ship samples containing PCBs, the samples must be shipped in an inner metal packaging (paint can) inside a 1A2 outer steel drum. This method of packaging PCB samples is in accordance with FedEx variation FX-06, listed in Section 2 of the DGR.

4. Place each sample jar in a separate resealable plastic bag. Some UN specification packagings contain the sample jar and plastic bag to be used when shipping the sample.

5. Place each sealed bag inside the approved UN specification container (or other appropriate container if a limited quantity or dry ice) and pack with enough noncombustible, absorbent, cushioning material (such as vermiculite) to prevent breakage and to absorb liquid.

6. Place chain-of-custody forms in a resealable plastic bag and either attach it to the inside lid of the container or place it on top inside the container. Place instructions for returning the container to the shipper on the inside lid of the container as appropriate. Close and seal the shipping container in the manner appropriate for the type of container being used.

7. Label and mark each package appropriately. All irrelevant markings and labels need to be removed or obliterated. All outer packagings must be marked with proper shipping name; identification number; and name, address, and phone numbers of the shipper and the recipient. For carbon dioxide, solid (dry ice), the net weight of the dry ice within the package needs to be marked on the outer package. For limited quantity shipments, the words "limited quantity" or "LTD. QTY." must be marked on the outer package. Affix the appropriate hazard label to the outer package. If the material being shipped contains a subsidiary hazard, then a subsidiary hazard label must also be affixed to the outer package. The subsidiary hazard label is identical to the primary hazard label except that the class or division number is not present. It is acceptable to obliterate the class or division marking on a primary hazard label and use it as the subsidiary hazard label. If using cargo aircraft only packing instructions, then the "Cargo Aircraft Only" label must be used. Package orientation labels (up arrows) must be placed on opposite sides of the outer package. Figure 1 depicts a properly marked and labeled package.

8. If using an overpack (see definition), mark and label the overpack and each outer packaging within the overpack as described in step 7. In addition, the statement "INNER PACKAGES COMPLY WITH PRESCRIBED SPECIFICATIONS" must be marked on the overpack.

9. Attach custody seals, and fill out the appropriate shipping papers as described in Section 2.4.

2.4 SHIPPING PAPERS FOR HAZARDOUS SAMPLES

A "Shippers Declaration for Dangerous Goods" and "Air Waybill" must be completed for each shipment of hazardous samples. Four copies of the Shipper's Declaration are required and it must be typed. FedEx supplies a Dangerous Goods Airbill to its customers; the airbill combines both the declaration and the waybill. An example of a completed Dangerous Goods Airbill is depicted in Figure 2. A shipper's declaration must contain the following:

- Name and address of shipper and recipient
- Air waybill number (not applicable to the HMR)
- Page ___ of ___
- Shipper's reference number (project number)
- Deletion of either "Passenger and Cargo Aircraft" or "Cargo Aircraft Only," whichever does not apply
- Airport or city of departure
- Airport or city of destination
- Deletion of either "Non-Radioactive" or "Radioactive," which ever does not apply
- The nature and quantity of dangerous goods. This includes the following information in the following order (obtained from the List of Dangerous Goods in the DGR): proper shipping name, class or division number, UN identification number, packing group number, subsidiary risk, quantity in liters or kilograms (kg), type of packaging used, packing instructions, authorizations, and additional handling information. Authorizations include the words "limited quantity" or "LTD. QTY." if shipping a limited quantity, any special provision numbers listed in the List of Dangerous Goods in the DGR, and the variation "USG-14" when a technical name is required after the proper shipping name but not entered because it is unknown.

- Signature for the certification statement
- Name and title of signatory
- Place and date of signing certification
- A 24-hour emergency response telephone number for use in the event of an incident involving the dangerous good
- Emergency response information attached to the shipper's declaration. This information can be in the form of a material safety data sheet or the applicable North American Emergency Response Guidebook (NAERG; DOT 1996) pages. Figure 3 depicts the appropriate NAERG emergency response information for "Flammable liquids, n.o.s." as an example.

Note that dry ice does not require an attached shipper's declaration. However, the air waybill must include the following on it: "Dry ice, 9, UN1845, ____ x ____ kg." The blanks must include the number of packages and the quantity in kg in each package. If using FedEx to ship dry ice, the air waybill includes a box specifically for dry ice. Simply check the appropriate box and enter in the number of packages and quantity in each package.

The HMR requirements for shipping papers are located in 49 CFR 172 Subpart C.

3.0 POTENTIAL PROBLEMS

The following potential problems may occur during sample shipment:

- Leaking package. If a package leaks, the carrier may open the package, return the package, and if a dangerous good, inform the Federal Aviation Administration (FAA), which can result in fines.

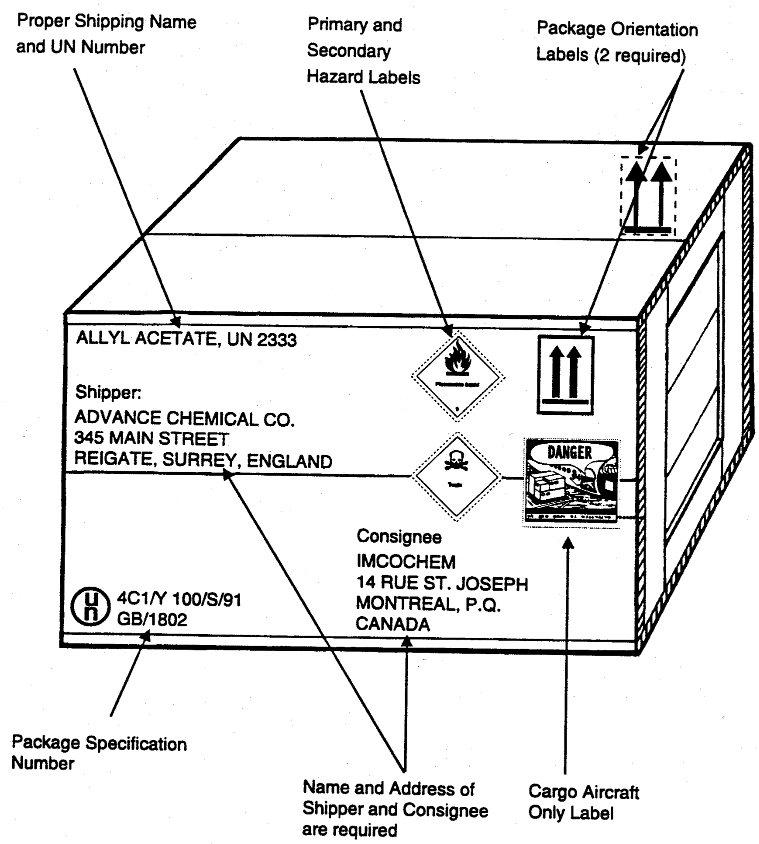
- Improper labeling and marking of package. If mistakes are made in labeling and marking the package, the carrier will most likely notice the mistakes and return the package to the shipper, thus delaying sample shipment.

- Improper, misspelled, or missing information on the shipper's declaration. The carrier will most likely notice this as well and return the package to the shipper.

Contact FedEx with questions about dangerous goods shipments by calling 1-800-463-3339 and asking for a dangerous goods expert.

Also contact Tetra Tech health and safety representatives using the website identified on Page 3 of this SOP.

FIGURE 1
EXAMPLE OF A CORRECTLY MARKED AND LABELED DANGEROUS GOODS PACKAGE



Source: International Air Transport Association (IATA). 1997.

FIGURE 2

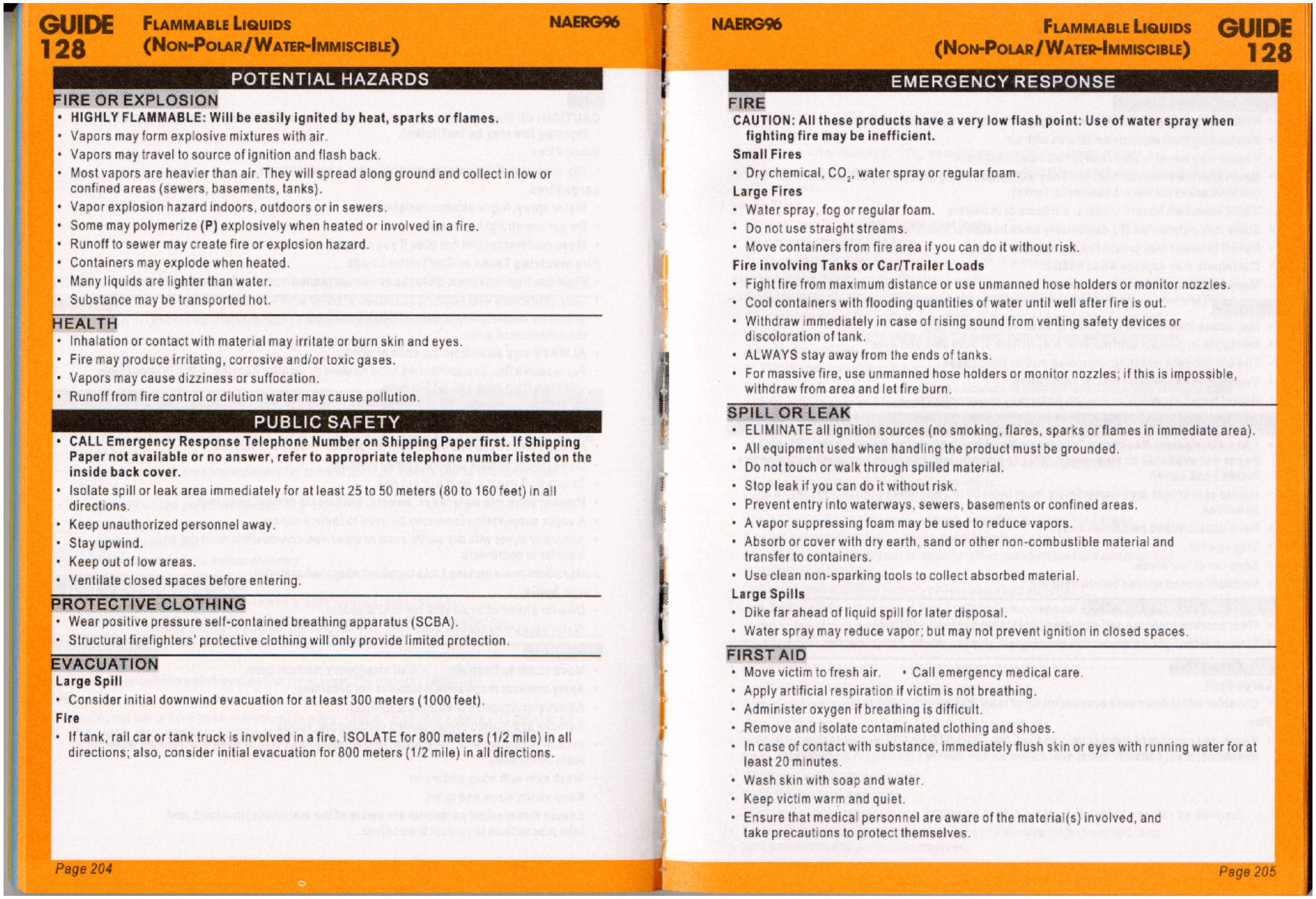
EXAMPLE OF A DANGEROUS GOODS AIRBILL

Filling Out the FedEx Dangerous Goods Airbill

- The Dangerous Goods Airbill has two sections
  - The top section of the page is the airbill portion.
  - The bottom section is the Shipper's Declaration for Dangerous Goods.
- The sender *must complete* the following fields on the pre-printed airbill:
  - Section 1: Date
  - Section 1: Sender's Name
  - Section 7: Total Packages
  - Section 7: Total Weight
- Declaration for Dangerous Goods:
  - Under the section labeled "Proper Shipping Name" fill in the infectious substance (i.e., HIV, HCV, etc.) in the parentheses.
  - Under the "Quantity and Type of Packing" section, fill in the amount of specimen in the box (in mls).
  - List an emergency telephone number in the space provided at the bottom of the airbill.
  - Sign and date the airbill in the bottom right corner.

IMPORTANT: You must follow explicitly all packaging and labeling instructions for shipping infectious substances. Correct spelling and legibility are important. Otherwise, your package will be delayed or may be rejected by FedEx.

FIGURE 3
NAERG EMERGENCY RESPONSE INFORMATION
FOR FLAMMABLE LIQUIDS, N.O.S.



GUIDE 128 — FLAMMABLE LIQUIDS (NON-POLAR/WATER-IMMISCIBLE) — NAERG96

POTENTIAL HAZARDS

FIRE OR EXPLOSION
- **HIGHLY FLAMMABLE: Will be easily ignited by heat, sparks or flames.**
- Vapors may form explosive mixtures with air.
- Vapors may travel to source of ignition and flash back.
- Most vapors are heavier than air. They will spread along ground and collect in low or confined areas (sewers, basements, tanks).
- Vapor explosion hazard indoors, outdoors or in sewers.
- Some may polymerize (P) explosively when heated or involved in a fire.
- Runoff to sewer may create fire or explosion hazard.
- Containers may explode when heated.
- Many liquids are lighter than water.
- Substance may be transported hot.

HEALTH
- Inhalation or contact with material may irritate or burn skin and eyes.
- Fire may produce irritating, corrosive and/or toxic gases.
- Vapors may cause dizziness or suffocation.
- Runoff from fire control or dilution water may cause pollution.

PUBLIC SAFETY
- **CALL Emergency Response Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, refer to appropriate telephone number listed on the inside back cover.**
- Isolate spill or leak area immediately for at least 25 to 50 meters (80 to 160 feet) in all directions.
- Keep unauthorized personnel away.
- Stay upwind.
- Keep out of low areas.
- Ventilate closed spaces before entering.

PROTECTIVE CLOTHING
- Wear positive pressure self-contained breathing apparatus (SCBA).
- Structural firefighters' protective clothing will only provide limited protection.

EVACUATION

Large Spill
- Consider initial downwind evacuation for at least 300 meters (1000 feet).

Fire
- If tank, rail car or tank truck is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions.

Page 204

NAERG96 — FLAMMABLE LIQUIDS (NON-POLAR/WATER-IMMISCIBLE) — GUIDE 128

EMERGENCY RESPONSE

FIRE

CAUTION: All these products have a very low flash point: Use of water spray when fighting fire may be inefficient.

Small Fires
- Dry chemical, CO_2, water spray or regular foam.

Large Fires
- Water spray, fog or regular foam.
- Do not use straight streams.
- Move containers from fire area if you can do it without risk.

Fire involving Tanks or Car/Trailer Loads
- Fight fire from maximum distance or use unmanned hose holders or monitor nozzles.
- Cool containers with flooding quantities of water until well after fire is out.
- Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
- ALWAYS stay away from the ends of tanks.
- For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn.

SPILL OR LEAK
- ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area).
- All equipment used when handling the product must be grounded.
- Do not touch or walk through spilled material.
- Stop leak if you can do it without risk.
- Prevent entry into waterways, sewers, basements or confined areas.
- A vapor suppressing foam may be used to reduce vapors.
- Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers.
- Use clean non-sparking tools to collect absorbed material.

Large Spills
- Dike far ahead of liquid spill for later disposal.
- Water spray may reduce vapor; but may not prevent ignition in closed spaces.

FIRST AID
- Move victim to fresh air.
- Call emergency medical care.
- Apply artificial respiration if victim is not breathing.
- Administer oxygen if breathing is difficult.
- Remove and isolate contaminated clothing and shoes.
- In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes.
- Wash skin with soap and water.
- Keep victim warm and quiet.
- Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

Page 205

Source: DOT and others. 1996.

SOP APPROVAL FORM

TETRA TECH EM INC.

ENVIRONMENTAL STANDARD OPERATING PROCEDURE

RECORDING OF NOTES IN FIELD LOGBOOK

SOP NO. 024

REVISION NO. 1
May 18, 1993

Last Reviewed: December 2008

RRiesing
Quality Assurance Approved

December 5, 2008
Date

1.0 BACKGROUND

The field logbook should contain detailed records of all the field activities, interviews of people, and observations of conditions at a site. Entries should be described in as much detail as possible so that personnel can accurately reconstruct, after the fact, activities and events during their performance of field assignments. Field logbooks are considered accountable documents in enforcement proceedings and may be subject to review. Therefore, the entries in the logbook must be accurate and detailed; and they must reflect the importance of the field events.

1.1 PURPOSE

The purpose of this standard operating procedure (SOP) is to provide guidance to ensure that logbook documentation for any field activity is correct, complete, and adequate. Logbooks are used for identifying, locating, labeling, and tracking samples. A logbook should document any deviations from the project approach, work plans, quality assurance project plans, health and safety plans, sampling plans, and any changes in project personnel. They also serve as documentation of any photographs taken during the course of the project. In addition, the data recorded in the logbook may assist in the interpretation of analytical results. A complete and accurate logbook also aids in maintaining good quality control. Quality control is enhanced by proper documentation of all observations, activities, and decisions.

1.2 SCOPE

This SOP establishes the general requirements and procedures for recording notes in the field logbook.

1.3 DEFINITIONS

None

1.4 REFERENCES

Compton, R.R. 1985. *Geology in the Field*. John Wiley and Sons. New York, N.Y.

1.5 REQUIREMENTS AND RESOURCES

The following items are required for field notation:

- Field logbooks
- Ballpoint pens with permanent ink
- 6-inch ruler (optional)

Field logbooks should be bound (sewn) with water-resistant and acid-proof covers; they should have preprinted lines and wide columns. They should be approximately 7 1/2 by 4 1/2 inches or 8 1/2 by 11 inches in size. Loose-leaf sheets are not acceptable for field notes. If notes are written on loose paper, they must be transcribed as soon as possible into a regular field logbook by the same person who recorded the notes.

Logbooks can be obtained from an individual's office supply room or directly from outside suppliers. Logbooks must meet the requirements specified in this SOP and should include preprinted pages that are consecutively numbered. If the numbers must be written by hand, the numbers should be circled so that they are not confused with data.

2.0 PROCEDURES

The following subsections provide general guidelines and formatting requirements for field logbooks, and detailed procedures for completing field logbooks.

2.1 GENERAL GUIDELINES

- A separate field logbook must be maintained for each project. If a site consists of multiple subsites, designate a separate logbook for each subsite. For special tasks, such as periodic well water-level measurements, data from multiple subsites may be entered into one logbook that contains only one type of information.
- All logbooks must be bound and contain consecutively numbered pages.
- No pages can be removed from the logbook for any purpose.

- All field activities, meetings, photographs, and names of personnel must be recorded in the site logbook.
- Each logbook pertaining to a site or subsite should be assigned a serial number based on the date the logbook is issued to the project manager. The first issued logbook should be assigned number 1, the next issued logbook assigned number 2, and so on. The project manager is to maintain a record of all logbooks issued under the project.
- All information must be entered with a ballpoint pen with waterproof ink. Do not use pens with "wet ink," because the ink may wash out if the paper gets wet. Pencils are not permissible for field notes because information can be erased. The entries should be written dark enough so that the logbook can be easily photocopied.
- Do not enter information in the logbook that is not related to the project. The language used in the logbook should be factual and objective.
- Begin a new page for each day's notes.
- Write notes on every line of the logbook. If a subject changes and an additional blank space is necessary to make the new subject title stand out, skip one line before beginning the new subject. Do not skip any pages or parts of pages unless a day's activity ends in the middle of a page.
- Draw a diagonal line on any blank spaces of four lines or more to prevent unauthorized entries.

2.2 LOGBOOK FORMAT

The layout and organization of each field logbook should be consistent with other field logbooks. Guidelines for the cover, spine, and internal pagination are discussed below.

2.2.1 FORMAT OF FIELD LOGBOOK COVER AND SPINE

Write the following information in clear capital letters on the front cover of each logbook using a Sharpie® or similar type permanent ink marker:

- Logbook identification number
- The serial number of the logbook (assigned by the project manager)
- Name of the site, city, and state
- Name of subsite if applicable
- Type of activity

- Beginning and ending dates of activities entered into the logbook
- "Tetra Tech EM Inc." City and State
- "REWARD IF FOUND"

Some of the information listed above, such as the list of activities and ending dates, should be entered after the entire logbook has been filled or after decision that the remaining blank pages in the logbook will not be filled.

The spine of the logbook should contain an abbreviated version of the information on the cover: for example, "1, Col. Ave., Hastings, 5/88 - 8/88."

2.2.2 First Page of the Field Logbook

Spaces are usually provided on the inside front cover (or the opening page in some logbooks), for the company name ("Tetra Tech EM Inc."), address, contact name, and telephone number. If preprinted spaces for this information are not provided in the logbook, write the information on the first available page.

2.3 ENTERING INFORMATION IN THE LOGBOOK

Enter the following information at the beginning of each day or whenever warranted during the course of a day:

- Date
- Starting time
- Specific location
- General weather conditions and approximate temperature
- Names of personnel present at the site. Note the affiliation(s) and designation(s) of all personnel
- Equipment calibration and equipment models used.
- Changes in instructions or activities at the site
- Levels of personal protective clothing and equipment

- A general title of the first task undertaken (for example, well installation at MW-11, decon at borehole BH-11, groundwater sampling at MW-11)
- Approximate scale for all diagrams. If this can't be done, write "not to scale" on the diagram. Indicate the north direction on all maps and cross-sections. Label features on each diagram.
- Corrections, if necessary, necessarily including a single line through the entry being corrected. Initial and date any corrections made in the logbook.
- After last entry on each page, initials of the person recording notes. No information is to be entered in the area following these initials.
- At the end of the day, signature of the person recording notes and date at the bottom of the last page. Indicate the end of the work day by writing "Left site at (time)." A diagonal line must be drawn across any remaining blank space at the bottom of this last page.

The following information should be recorded in the logbook after taking a photograph:

- Time, date, location, direction, and, if appropriate, weather conditions
- Description of the subject photographed and the reason for taking the picture
- Sequential number of the photograph and the film roll number or disposable camera used (if applicable)
- Name of the photographer.

The following information should be entered into the logbook when collecting samples:

- Location description
- Name(s) of sampler(s)
- Collection time
- Designation of sample as a grab or composite sample
- Type of sample (water, sediment, soil gas, etc.)
- On-site measurement data (pH, temperature, specific conductivity)
- Field observations (odors, colors, weather, etc.)
- Preliminary sample description
- Type of preservative used
- Instrument readings.

If pre-printed field data forms are available (forms such as the micropurge field data collection form), data should be entered on these pre-printed forms rather than into field logbooks. Note in the logbook that the field data are recorded on separate forms.

2.4 PRECAUTIONS

Custody of field logbooks must be maintained at all times. Field personnel must keep the logbooks in a secure place (locked car, trailer, or field office) when the logbook is not in personal possession. Logbooks are official project documents and must be treated as such.